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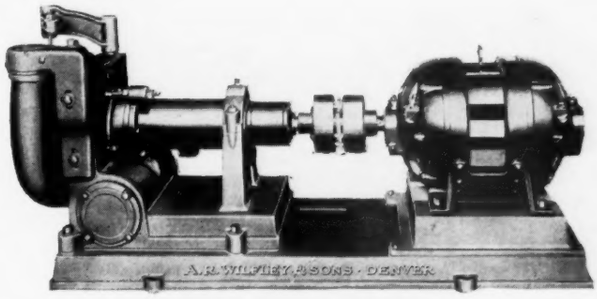
Rock Products

With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

Chicago, August 16, 1930 | Issued Every Other Week | Volume XXXIII, No. 17

What Led a Prominent Cement Manufacturer to Buy Wilfley Slurry Pumps—

"The original appeal to us was because they have no stuffing boxes. Previous experience with other pumps in cement plants had developed the fact that this was by far the most costly item in their operation and the Wilfley Pumps were purchased in order to avoid, if possible, this expense."



—And What This Manufacturer Says After Using Them—

"It is a pleasure to say that these pumps have given us very satisfactory results. We have found that they are thoroughly reliable in operation and that the parts when worn can be renewed cheaply and quickly although we have not had to renew any of them with less than ten months' service."

The reason given by this cement manufacturer for buying Wilfley Slurry Pumps is so logical and is so verified by results that other manufacturers could to their advantage follow this operator's example.

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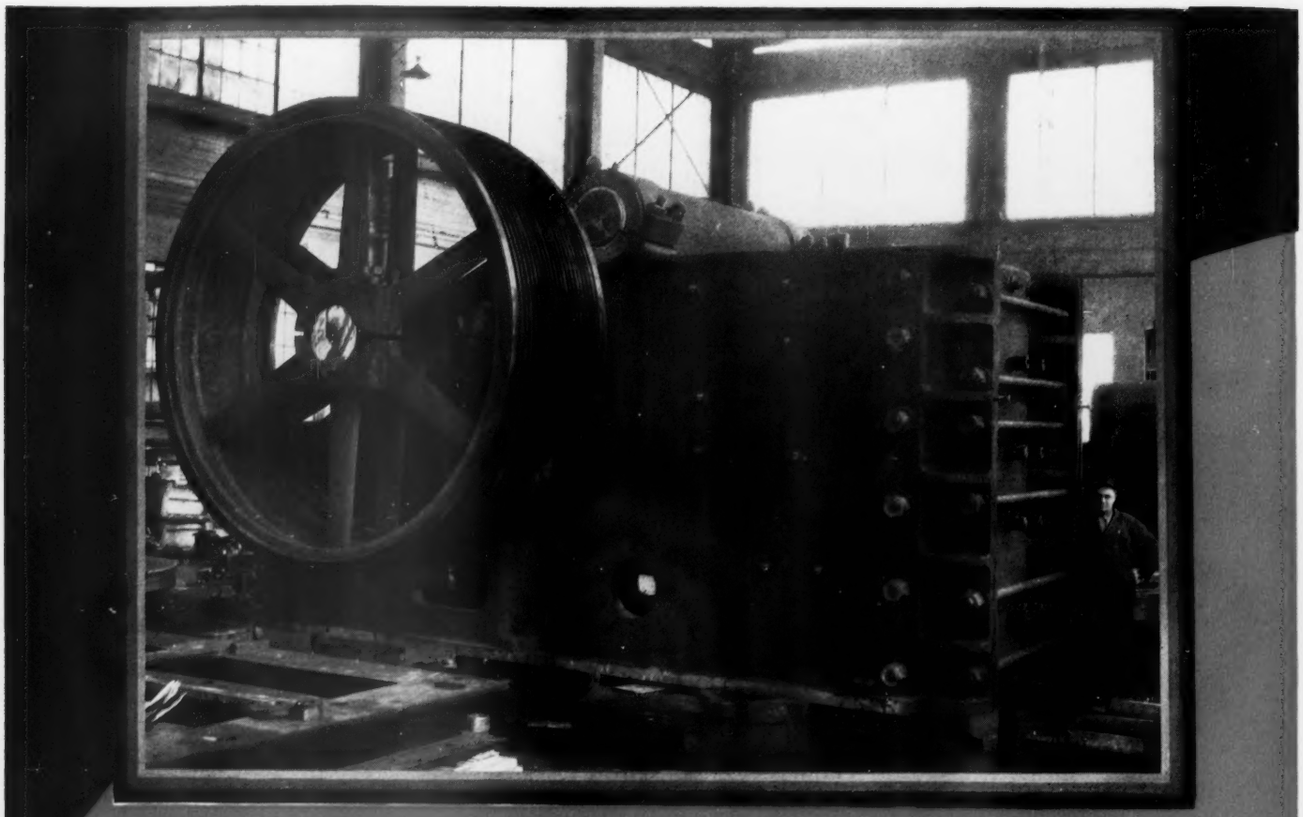

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THE above illustration shows a 56" x 72" BUCHANAN Type "C" All-Steel Crusher in our Plant just before shipment to The Safe Harbor Water Power Corporation. This giant BUCHANAN has the responsibility of crushing the large massive pieces of extremely hard trap rock. A long list of records established under equally difficult operating conditions was the principal deciding factor favoring the installation of the ever dependable BUCHANAN Type "C" All-Steel Crusher.

Write for literature

BUCHANAN

C. G. BUCHANAN COMPANY, INC.
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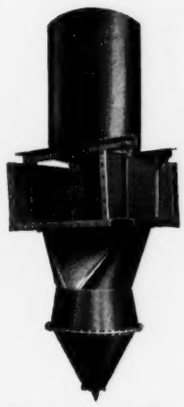
West Point, Texas, plant uses modern
LINK-BELT Equipment

Produces Six Sizes of Gravel, Three Grades of Sand



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Material passes from the last two screens into a sand flume, flowing through two Link-Belt Shaw Classifiers, then into a sand separator, making possible a production of three distinct grades of sand.

A complete description of Link-Belt Equipment for modern sand and gravel plants is given in Book 640, sent on request.

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(Rock Products is indexed in the "Industrial Arts Index," which can be found in any Public Library)

TRADEPRESS PUBLISHING CORPORATION
542 South Dearborn Street, Chicago, Illinois, U. S. A.

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SUBSCRIPTION—Two dollars a year to United States and Possessions. Three dollars a year to Canada and foreign countries. Twenty-five cents for single copies

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Rock Products
With which is Incorporated CEMENT and ENGINEERING NEWS Founded 1896

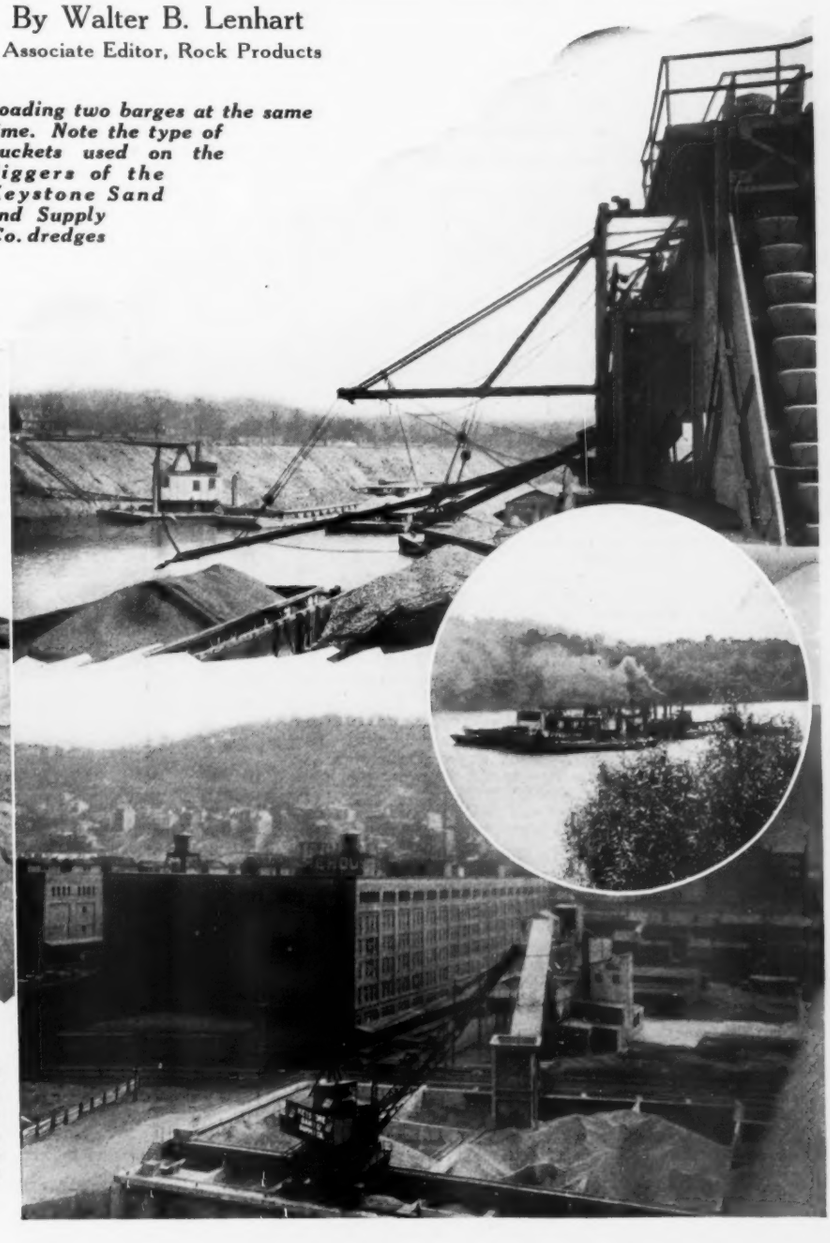
Volume XXXIII | Chicago, August 16, 1930 | Number 17

Sand and Gravel Industry on the Upper Ohio and Allegheny Rivers

News Items on Developments in Western Pennsylvania—Where This Year's Construction Business Is Going Strong

By Walter B. Lenhart
Associate Editor, Rock Products

WESTERN PENNSYLVANIA is enjoying a fairly large volume of business this season. This comparatively large volume of business cannot be attributed to any other factor than a result of the action of state, county and municipal officials in answering President Hoover's request for



Loading two barges at the same time. Note the type of buckets used on the diggers of the Keystone Sand and Supply Co. dredges

Above, a typical distribution yard on the Ohio river, this one at Freedom, Penn. These yards are numerous and strategically located. The view at the right is one of the Keystone plants in Pittsburgh. The circle gives a glimpse of Dredge No. 9 of the Keystone fleet at work on the Ohio

increased activities in highway building and other public-works programs. For that reason, the peak of this activity will probably be passed during this year, and unless industrial activities are started, or more state money made available, the Pennsylvania producer of aggregates will not be in much better shape during 1931 than some others are now in other localities.

In the western part of the state construction of industrial and commercial buildings, apartments, homes, etc., is universally at low ebb, and if it were not for the present highway program this picture of the local aggregate industry would be anything but pleasing.

One construction job that deserves special mention is the highway down the Ohio river starting at Pittsburgh. It is only a few short miles in length, but owing to the topography, several large concrete bridges of immense proportions will be required. It might be added that there are also now under construction two bridges across the Ohio river proper, both bridges being close to the city.

Prices were said to be fairly firm, with some weaknesses in spots, although none of the producers complained seriously.

Business in general in the steel producing sections of Pennsylvania, which means literally the territory of the upper Ohio river and its two main tributaries, the Allegheny and the Monogahela, is very unsatisfactory. This condition does not affect the sand and gravel industry to any great extent except indirectly, but to the flux-stone producers who make commercial aggregate as a secondary product it has had quite a serious effect. Flux-stone producers in many cases have curtailed production of furnace stone as much as 50%. The aggregate or road-stone end of their business is quite brisk. As the producers' plants are equipped primarily to produce flux stone, the plants being designed to produce a maximum amount of flux stone with a minimum amount of the finer sizes of stone, it has not been easy to operate the plants efficiently to produce road stone as the major product, and the flux stone as the byproduct. The plants, in other words, are not flexible, but

The First of a Series of Stories on the History and Development of the *Sand and Gravel industry by*

The

Iron City Sand & Gravel Co.

There is romance in sand and gravel! The history of sand, from the age-old glacial periods to the time it is scooped from the mysterious depths of the river, is a fascinating story.

And the strange things those huge dredges dig dripping from the river bottoms—gold and quartz, arrow heads and spear heads, muskets and cannon, bones of pre-historic animals, and the ribs of modern boats, all lost and buried in the mud of our rivers long, long ago.

Not only do we find amusement and education in the study of sand formations and sources, but the utilities of sand are equally interesting.

Without sand there would be no bricks, tile, artificial stone, concrete blocks, glass, pottery, mortar, or concrete, and without these how would we construct our schools and churches, our office buildings, hotels and homes, our highways and our bridges?

It is because of the many important parts that sand and gravel play in modern life that we have decided to tell their story, and we feel sure that you, the reader of this series, will profit not only from the pleasure in learning about sand and gravel themselves, but also in the increased knowledge of one of Pittsburgh's great industries.

The Second of a Series of Stories on the History and Development of the *Sand and Gravel Industry*

The

Sun, Frost, Snow, Ice and Wind

—are the great manufacturers of sand and gravel, one of man's most important allies in modern life.

There are two general sources of sand and gravel found in the Allegheny and Ohio Rivers: First: That derived from disintegration and decomposition by weathering processes of the nearly horizontal beds of sand stone, which were originally laid down on the ocean floor one hundred million or more years ago and later elevated high above sea level by mountain-making movements into and through which the Allegheny and Ohio Rivers have cut their valleys.

Second: Glaciers are responsible for the other source. To the north, in Canada, rock croppings occurred, and during the great ice age which lasted, perhaps, one-half million or more years and which preceded the present geological period by at least twenty-five ,thousand years, great glaciers, in some instances over a mile thick, accumulated over Northern Canada and moved southward. These glaciers carried with them the soil mantel derived from such rocks as granite, that carry considerable quantities of minerals like quartz, that enter into the composition of sand and gravel. As these glaciers grew in thickness in their southward movement they also ground away a considerable thickness of the underlying bed rock, thus adding to the quantity of loose sand, gravel and clay that they had already encompassed into themselves. These glaciers got as far south as the head waters of the Allegheny River, where the melting was as fast as the forward movement. There the glaciers naturally dropped the debris that they had carried southward. In this way, large quantitie sof sand, gravel and silt were furnished the streams which flowed from the foot of the glaciers, much of which was carried to the Allegheny and Ohio Rivers and deposited all along their courses.

Iron City Sand & Gravel Co.

General Offices, Bessemer Building, Pittsburgh.

Two of a series of newspaper advertisements placed by members of the Western Pennsylvania Sand and Gravel Producers' Association in their local papers to promote use of their product. Others are shown on succeeding pages

undoubtedly if this condition continues to any extent steps will be taken by the producers to put their flux-stone plants on a more efficient operating basis for the product now in most demand.

	Concrete pavement	Grading and drainage	Total
Carried over from 1929	489.69 miles	73.61 miles	563.29 miles
Awarded during 1930	479.64 miles	94.18 miles	573.82 miles
	969.33 miles	167.79 miles	1137.11 miles

Change in Highway Income

Pennsylvania had a 4-cent gas tax. This levy was secured on the pleas that it was needed to help keep the road-building program moving, but it was found unnecessary and accordingly the tax was reduced to 3 cents on July 1. The state has a "permanent" tax of 2 cents per gallon and had an additional "emergency" tax of 2 cents per gallon. The emergency tax is now only 1 cent per gallon.

Some opinion was expressed that if the state did not need the extra funds for the present program, why should not the program be extended and leave the tax where it was. The public, in this case, was no gainer, for it was reported in many cities that as soon as the state dropped off the 1 cent tax the oil companies boosted the price 1 cent, leaving the price the consumer paid the same. We have heard of many instances, in other states, where attempts have been made directly and indirectly to divert highway gas tax funds for educational and other purposes, but this appears to be the first instance where the diversion amounts to one of from the pockets of the public to those of the oil companies.

Unquestionably Pennsylvania could use wider highways in some places, could eliminate grade crossings; and when the present program is completed there will still remain much work to be done. Many voiced the opinion that opposition to the 4-cent tax was due to the distribution of funds; namely, that the cities whose motorists supplied the major part of the money were not receiving their proportion of the expenditures. This sort of a problem is always ticklish, and some would complain no matter how the funds were territorially divided.

A Whale of Highway Program

The state as a whole has a tremendous highway program that is being vigorously pushed. The following figures summarize the mileage:

In addition to the above there were lettings early in July of an additional 120 miles of highway, making a complete total for 1930 thus far of 1257.11 miles. The above figures refer only to concrete highway work being done by the state, which is also macadamizing about 300 miles of highway.

The highway department has appointed a special committee to look after some phases of the highway work in that state. One member of the committee is from a surety company, one from the slag producers, one from the sand and gravel industry, and one from the crushed-stone industry. This committee handles the largest road program that any state has had or probably will have for some time in the future. Weekly reports are received by the members of this committee showing the status of all the various highway jobs under way; the amount of work done and to be done, and other information so that the reader of the report has a picture of the project. Figures on this report also show the relative ratings of the various contractors as to their responsibility and ability as judged from the work in question. One competent observer stated that about 50% of the highway contractors in the state had taken their contracts too cheaply and were likely to fail financially.

The state of Pennsylvania is fortunate in having some of the most capable men in America as the heads of the various highway departments. All of the important highway officials of the state are presidents of the important national associations, indicating the recognition of merit both locally and nationally. Samuel Eckles, chief engineer of the Pennsylvania State Highway Department, is also president of the Association of State Highway Officials: W. A. Van Duser, assistant chief engineer of the Pennsylvania State Highway Department, is president of the American Road Builders Association, and H. S. Mattimore, engineer of tests, is president of the Highway Testing Engineers of America.

The preparation of gravel aggregate in the Pittsburgh area, in years gone past, had been allowed to deteriorate to such an ex-

The third of a series of stories on the history and development of the sand and gravel industry

Remember when they used to wade across the Allegheny?

NOT many will recall that back in those hectic days immediately preceding, during, and just following the Civil War, that in the summer months the good people of Pittsburgh were fording the Allegheny River along about Sixth St., or wading across when so minded, making their way easily from sand bar to sand bar that lay gleaming and baking beneath the summer sun.

At that time, during the 50's and 60's, it was the practice of those engaged in the sand business to go out onto the bars, scoop the sand into piles with hand shovels, screen it to remove the gravel, and then load the sand into wagons and carts driven out to the bars thru the shallow water.

This work was all laboriously done by hand until about '56, when the first dredges came into use. These dredges were small side wheelers, costing approximately one thousand dollars each. They had no rudders, being guided by poles manipulated by men on the decks. The sand from the dredges was loaded into barges, which were then moved to the river bank and from these the sand was shoveled into wagons driven into the water alongside. All this was tediously done by hand.

About 1874 a wooden box with a hinged bottom was rigged on a pivoting pole so that when loaded on the barge it could be swung around and emptied into the waiting wagons on shore.

This pitifully inadequate system was in use until 1880, when the first clam shell buckets and hoisting engines made their appearance and virtually eliminated the toil and slowness of hand labor. The clam shell buckets and hoisting engines are used today, altho in greatly improved forms.

Until 1880 sand was used mostly in brick and masonry work, for plaster, and in the blast furnaces. The gravel was considered a waste, because it had no use with the exception of an insignificant demand for street surfacing.

It was in 1880 that concrete came into use, and gravel was demanded for its manufacture. Thus this year marks the beginning of a new era in structural work and methods. Without concrete there would be no buildings, bridges, and streets of the type that is familiar to us today.

The present Pittsburgh and Lake Erie Railroad Station rests on the first concrete poured in Pittsburgh for a structure of any importance.

The coming of concrete gave new life and vigor to the sand and gravel industry, and from 1880 to the present its growth has been rapid and substantial.

The pioneer sand and gravel workers made the rivers what they are today. It is largely to their ceaseless dredging that we owe the present channels and navigable depths of the Allegheny and Ohio rivers.

Comparing the old methods of digging and loading sand by the bushel to the present methods of handling it by the ton, it is, nevertheless, amazing the amount of work that was accomplished by hand. The reasons, undoubtedly, was that the men engaged in this work, such as the Stolzenbachs, Pfeils, Rodgers and Davisons, were giants who gloried in their brawn, and who toiled at their quotidian tasks in an ecstasy of physical effort. They fought the stubborn rivers to victory, hampered by makeshift gear, leaky boats, storms and floods. Enlisted with them in their struggle was first the fighting Irish, later came the husky Germans, to be followed by the hardy North of Ireland men and the Poles.

Next Monday we will tell how we get the sand and gravel today from the rivers with giant dredges that cost well in excess of a quarter of a million dollars and whose great jaws claw into the rivers fifty feet below the surface and tear tons of sand and gravel loose with every bite.

Iron City Sand and Gravel Co.

General Offices, Bessemer Building, Pittsburgh.

Look for the Fourth Story in Next Monday's Press.

The third in the series of newspaper ads

tent that gravel lost considerable ground, while crushed slag was gradually beginning to assume a position of greater importance. Until about the time of the World War the producers operated quite independently. During those years came the recognition of the fact that unless there was more co-operation among the producers, and a better standard maintained, the sand and gravel industry would suffer still greater losses in tonnage to slag and crushed limestone.

Gravel Producers Strengthen Their Position

This co-operative tendency gradually grew year by year and has welded the producers into a unit, it might be said, that is working with its main purpose to build up the industry by supplying the markets with the best material it is possible for the producers to deliver. Comparatively recently this co-operative movement resulted in the formation of the Western Pennsylvania Sand and Gravel Producers' Association. The association members placed Ray Warren, formerly with the state highway department, in charge as secretary and promotional engineer. Mr. Warren's main duties are to see that the producer members maintain a high quality product, so that no reflections can be cast on the material as a whole. The association members are the four largest producers in Pittsburgh, although other producers in adjacent territories sit in at their meetings. The members of the association represent a yearly production for 1929 of better than 5,000,000 tons of sand and gravel, from 11 dredges working on the Ohio and Allegheny rivers within a radius of 30 miles of Pittsburgh. These dredges undoubtedly could produce twice that amount if called upon to do so. The offices of the association are in the Empire building, Pittsburgh.

Not only was the formation of the association indicative of the co-operative feeling, but one can also see the effect in the nature of the newspaper advertising carried in the local papers by the individual producers. These advertisements devote most of the space to the promotion of sand and gravel rather than to the promotion of the particular producer's sand and gravel. As an example of the type of advertising, we reproduce a series of four advertisements that ran in a Pittsburgh newspaper containing interesting bits of information for any reader. After reading them one can agree with their author that "there is romance in the sand and gravel industry."

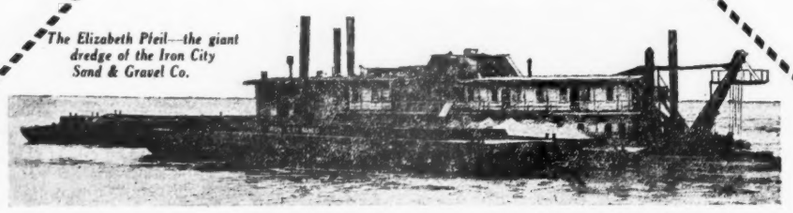
All Special Type Dredge Operations

The four largest producers in Pittsburgh are J. K. Davison and Bro.; the Iron City Sand and Gravel Co.; the Keystone Sand and Supply Co., and the McCrady-Rodgers Co. These four companies are members of the Western Pennsylvania Sand and Gravel Producers' Association, referred to previously.

All of their materials are produced by chain-bucket, ladder type dredges that operate on the Ohio river below Pittsburgh and on the Allegheny river above that city. The washed and screened products are prepared on the dredges and, after loading to barges, are towed to Pittsburgh or any of the river marketing points.

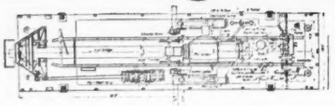
Comparatively long-distance towing is quite common; one company, it was reported, covered 105 miles of the river in its daily functioning. The average upstream tow will usually consist of six loaded barges having a net tonnage of from 3000 to 3300, although tows of 5000 tons have been recorded in relatively still water. The tugs used for towing range from steam to modern Diesel types and have loaded speeds up to four miles per hour and empty speeds up to 10½ miles per hour. Transportation costs will run a trifle over ½ cent per ton-mile, it was stated.

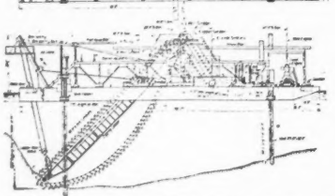
Gravel is quite plentiful on the rivers near Pittsburgh, broadly speaking; in fact, when size of gravel is left out of considera-



The Elizabeth Pfeil—the giant dredge of the Iron City Sand & Gravel Co.

The heart of a great business





A diagram of the Elizabeth Pfeil that shows why such equipment is so very expensive.

We are not thinking of the emotional heart here, but of the heart as the generator of life. It is in this latter sense that we speak of the great dredge, Elizabeth Pfeil, as the heart of our business—without her, or one like her, we could have no sand and gravel business, as we know that industry today.

There was a time when sand and gravel was plentiful near Pittsburgh, just as once it was possible to get sand and gravel from exposed bars and by simple, steam-shovel dredging in shallow water. But, just as coal and timber supplies have been exhausted close to Pittsburgh, so have the sand deposits, and it has become necessary to go farther and farther away for these materials.

Millions of tons of sand and gravel are taken from the rivers every year and, contrary to the popular idea, this material is not being replaced. The dams have deepened the water, which in turn has slowed the currents. This means, first, that now all sand must be dredged, sometimes at fifty and fifty-five foot depths, and second, that the sluggish currents no longer carry new sand and gravel to replace that which is taken out.

These necessities of dredging deeper and traveling greater distances for sand and gravel have brought into use powerful tow boats, great steel barges, and huge dredges like the Elizabeth Pfeil which cost more than a quarter of a million dollars and dig one million tons of sand and gravel every year from the beds of the rivers.

How much *is* a million tons of sand?

The best way to visualize one million tons of sand and gravel is to compare it, say, to the Oliver building, which is 110 feet wide, 120 feet long and 347 feet, or 25 stories high. If we were to take a space 110 feet by 120 feet and pile 1,000,000 tons of sand and gravel into it in a straight column, it would make a tower approximately five times higher than the Oliver building! Some sand pile!

If loaded into five-ton trucks, 1,000,000 tons of sand and gravel would fill 360 miles of trucks placed end to end, or 150 miles of 50-ton railroad cars.

And this mountain of material is produced by the *Elizabeth Pfeil* in one year!

A general view of the dredge *Elizabeth Pfeil*, designed and built by The Bucyrus Company, and operated by the Iron City Sand & Gravel Company, is shown above. This dredge is constructed on a steel hull 160 feet long, 40 feet wide and 7 feet deep, drawing 4.5 feet of water. Four 58-foot spuds weighing 10 tons each are provided to hold the dredge in position while in operation. The digging buckets are of eight cubic foot capacity, constructed of special alloy cast steel with a manganese steel lip. The chain consists of 87 buckets carried over tumblers at the ends of a steel ladder 95 feet long between tumbler centers. The digging ladder is pivoted at the upper end about the drive tumbler shaft, and is designed for a digging depth of 50 feet when suspended at an angle of 45 degrees.

A general drawing of this dredge, giving the location of the equipment and operating machinery, is shown above. The digging chain is driven by a 125hp., 690 rpm. wound-rotor induction motor, the main drive machinery being located on the lower deck. The motor is connected by a double reduction of spur gears and a friction clutch to the drive pulley at the left, from which the upper tumbler shaft is driven through a gear train by a 20-inch belt. The motor has a large overload capacity to supply the heavy torques required for hard digging.

The main drive motor is also used for operating the ladder hoist and spud hoists by means of clutches connecting the motor shaft through reduction gears to the hoist drums.

The material brought up by the digging buckets is discharged at the upper tumbler into a revolving screen, 7 feet and 8 feet 6 inches in diameter by 32 feet long, mounted on a slope of one in twelve. The sand and gravel are separated and the material too large to pass through the largest opening, 2.75 inches, is carried through the screen and returned to the river by a stone chute. The screen is revolved through reduction gears by a 50 hp., 690 rpm., wound-rotor induction motor, with an oil circuit-breaker and reversing drum controller for protection and speed control. In passing through the screen the material is subjected to strong sprays of water for the purpose of breaking it up and thoroughly washing out all clay and silt that might be present. Water for the revolving screen sprays and the hopper is supplied by an eight-inch pump, delivering 1800 gallons per minute and a four-inch pump delivering 430 gallons per minute. These pumps are direct-connected to squirrel-cage induction motors rated at 40 hp. and 20 hp. respectively.

The sand and gravel from the revolving screen are discharged into separate sumps at the two sides of the dredge, from which they are raised to the loading chutes by two bucket elevators, each elevator consisting of a chain of 34 four cubic foot buckets.

For movement of the barges and other similar duties, capstans are provided near the four corners of the hull, each of these being driven by a 20 hp. intermittent-rating, wound-rotor induction motor installed below deck. The capstans are controlled by means of primary switches and reversing drum controllers.

The power plant of the dredge, located in an engine room near the stern, consists of a 270 kv-a., three-phase, 60 cycle, 480 volt, 277 rpm. alternator direct-connected to a 300 hp. four-cycle, 13½ by 16 Diesel engine. Excitation is furnished by a 12.5 kw. 125 volt machine belted to the alternator shaft. A switchboard panel near the alternator is provided with an automatic oil circuit-breaker, and the necessary meters and auxiliary apparatus for control and protection of the power supply. A voltage regulator is also provided to maintain practically constant voltage at the operating motors.

To supply the steam required for siphoning barges and for the heating system, a vertical oil-fired boiler is provided in the engine room. Fuel for the dredge is brought in a fuel barge from which it is unloaded and stored in a 7,000-gallon between-deck tank by a geared pump driven by a two hp. squirrel-cage motor. A small auxiliary tank is located above deck for gravity feed to the boiler. Cooling water for the Diesel engine is taken from the river into a settling tank from which it is circulated by a centrifugal pump driven from the alternator shaft by a belt. Compressed air tanks and a small air compressor driven by a kerosene engine are also provided.

The regular crew of the dredge consists of captain, operator, two engineers, one elevator attendant, four deck hands and two cooks. Staterooms, dining room and other conveniences are provided for housing the crew. The dredge is equipped throughout with an electric lighting system and flood lights are installed on the bow gantry and at other points to facilitate night operation. The lighting system uses 32 volt lamps supplied by a 7.5 kv-a., 440 to 32-volt transformer, when the power plant is in operation. An auxiliary lighting generator driven by a kerosene engine is used at idle times.

Iron City Sand and Gravel Company

General Offices, Bessemer Building, Pittsburgh, Penna.

Number Four in a Series—Look for Number Five in Next Monday's Pittsburgh Press.

Human interest copy characterizes the newspaper advertising done by western Pennsylvania dealers in the fourth of the series

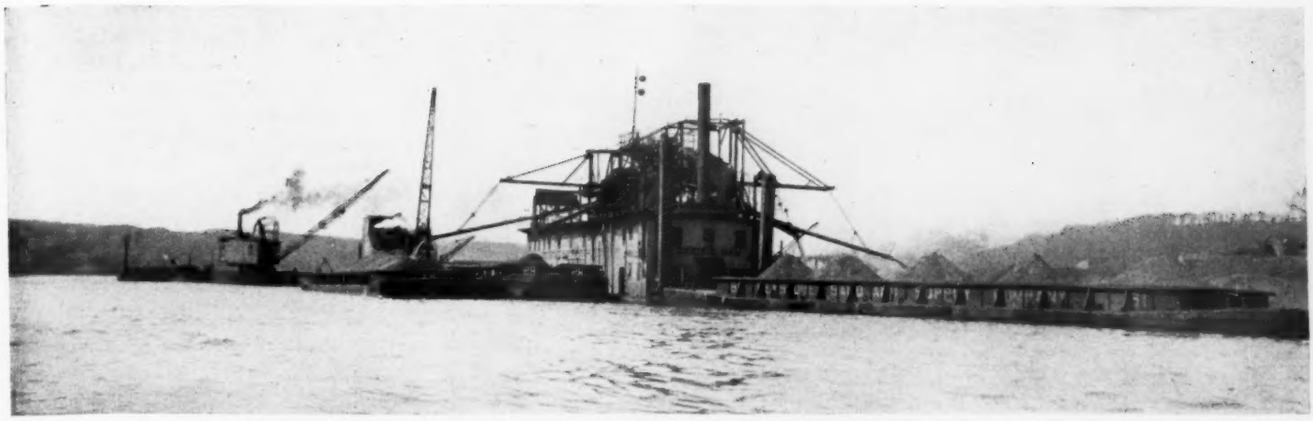


Photo taken about a year ago showing the digger No. 8 of the Keystone Sand and Supply Co. furnishing aggregate for Deadman's Island Dam

tion the river beds can be said to be full of gravel; but the commercial sizes, i.e., the smaller sizes (2¾-in. and smaller) are each year becoming scarcer, so that operations are being extended farther and farther from the heart of the city proper. Also, and an important point that must not be overlooked, is the nature of the gravel nearer the city, which, owing to contamination with debris, rubbish, tin cans and what not, would require special treatment to make it commercially available—and crushing would have to be universally adopted.

Contamination from coal is another bugbear of the gravels nearer the city, as it will be recalled that on the Ohio river at this point there are yearly hauls of millions of tons of coal. Many of these coal barges from time to time in the last century were wrecked and scattered their contents over wide areas of gravel beds. For these reasons it has been found more economical and more feasible for the producer of a better grade of gravel to work beds at comparatively great distances from the main markets, although the recent tendency appears to be to install crushers and gravel washing equipment and to work the deposits that do not require such a long haul. In this event, jigs or some similar washing equipment can be used to advantage to separate the coal and other materials of lower specific gravity from the gravel.

Two types of dredges; the one at the left, flush deck type, is gradually replacing the old hopper type shown at the right

River Improvement Increases Competition

Last year the Ohio river was opened for deep-water transportation from Pittsburgh to New Orleans. This was made possible by the construction of dams with locks at suitable places on the river. Between Rochester, Penn., and Pittsburgh there are four locks, and digger dredges operating near Rochester send their loads up the river via these locks. It requires about five minutes for a tug and tow to go through each lock. The locks are operated by the United States

The digger of the Oil City Sand and Gravel Co. at work on upper reaches of Allegheny River at Oil City, Penn.

Allegheny River Sand Corp. dredge in operation above, Kittanning, Penn., on the Allegheny

government and no charge is made for passage of boats; in fact, any boat, no matter how small, can pass the locks, provided the boat has a name.

One of the last locks to be built on the Ohio was that a few miles below Pittsburgh and is known as Deadman's Island dam. This dam is illustrative of the type used, and was of reinforced-concrete construction throughout. The dam itself was 1585 ft. long, 60 ft. wide at the base and 38 ft. high, and at the time I inspected the construction work, about a year ago, it was interesting to note that one of the digger dredges of the Keystone Sand and Supply Co. was operating a few hundred feet from the dam site and supplying the aggregate for the dam's construction; and at the same time the digger dredge was opening up the river channel for water transportation.

Two dams are now under construction on the upper Allegheny river, one at Kittanning, Penn., and one near Templeton, Penn., but the aggregate producers in those sections are not so favorably situated, and the construction company is supplying its own aggregate, using cableway excavators near the dam site. When these two dams are completed this fall, navigation of the Allegheny river at all seasons of the year will be possible to a point a few miles above

The prow of the Keystone's "Mary Alice." Note the bumpers for pushing barges

Reesedale, or roughly 60 miles from Pittsburgh. Incidentally, it might be said that one sand and gravel producer, the Allegheny River Sand Corp., has its plant at Reesedale.

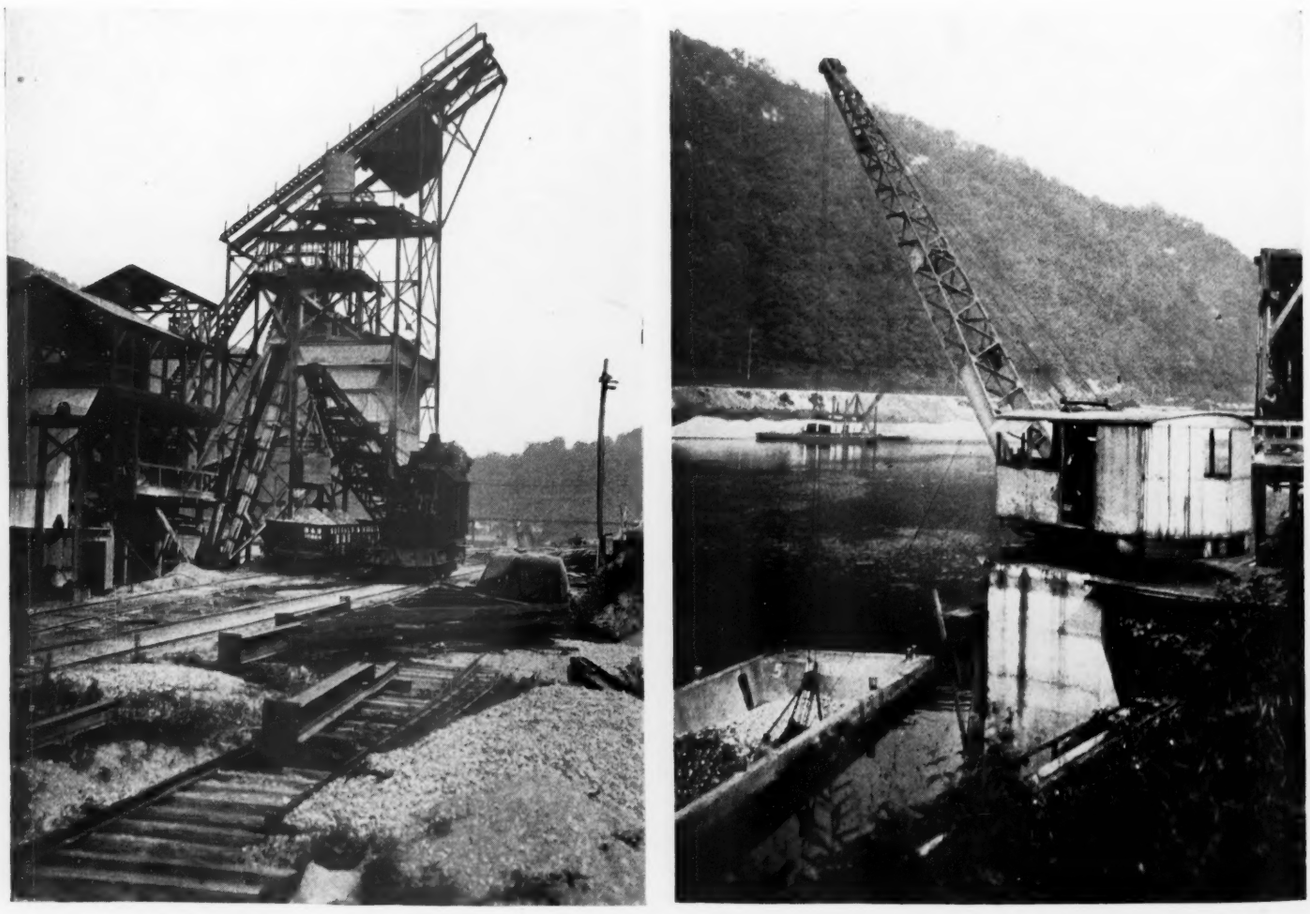
These two dams on the Allegheny are known as No. 9 and No. 10 and their completion is expected to create quite a boom in the upper Allegheny river points, for the district is rich in mineral wealth, notably coal, iron ore and limestone. There is possibility of a new cement plant being built somewhere up the Allegheny river.

Another possible development in the district is a canal to connect the Ohio river with the Great Lakes. One site that has great possibilities is the Beaver river valley that empties into the Ohio river at Rochester, Penn. According to reports, the project is more than a mere rumor, and should it be completed it would be of vital significance to the entire district, for even now there is a tendency for the steel mills and steel fabricators to move their plants to water transportation.

Beyond question, within a few years river transportation on the upper Ohio and its tributaries will assume great importance, and it will help western Pennsylvania to retain its leadership as a steel-producing section. There is talk of dam construction on up the Allegheny river even as far as Oil City, Penn. This would require between ten and eleven dams and locks, and yet is within the range of possibility in years to come.

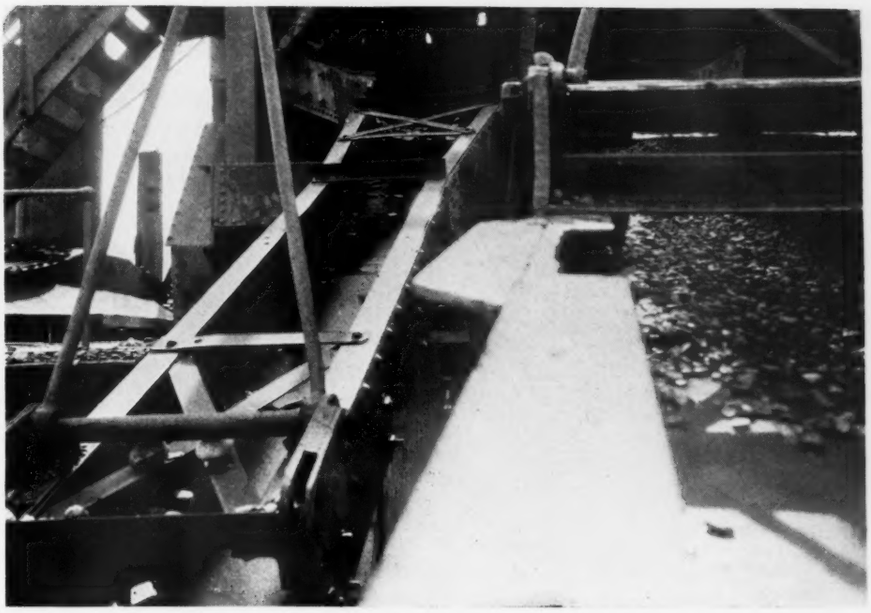
Pittsburgh Distribution Facilities

All of the four main producers in the Pittsburgh area proper have distribution



Two views from the shore plant of the Allegheny River Sand Corp. at Kittanning, Penn. The upper structure in the left-hand picture is portion of an old inclined skip equipment that has been replaced with elevators and belt conveyors. One of the unloading rigs is seen at the right

yards located at strategic points along the river so that it is possible to deliver barged material to the yards and the yards in turn can deliver to the jobs with a minimum haul. These yards are so strategically located that it is doubtful if any delivery of aggregate to any job in Pittsburgh requires more than a 15-minute haul. These yards in the outlying sections usually consist of an unloading crane, railroad switching facilities, truck scales, batchers, and overhead storage facilities. The tendency seems to be toward using smaller capacity overhead storage bins and to rely more on ground and barge storage. One producer stated that the use of batchers was on the decline and their importance, in his opinion, was becoming less each year. However, in view of the fact that transit mixing of concrete in the river towns above and below Pittsburgh is becoming quite a factor, the necessity of having batchers and their continued use will not only be justified but necessary.



Chutes on Keystone dredges are lined with 5/8-in. rubber, said to give ten times the wearing service of other surfaces

At one time the four principal producers of sand and gravel in Pittsburgh were all more or less in the ready-mixed concrete business as individuals. Later they pooled their interests and formed the Ready Mixed Concrete Co., the stock of which is equally divided among the four producers; and this company is run as a separate entity with one of the most modern ready-mixed plants in the state located near "the Point" in downtown Pittsburgh. This company's operation was described in detail in the June 8, 1929, issue of Rock Products. At present most of the ready-mixed concrete is being hauled in 4-yd. capacity agitator trucks of the Portland Concrete Machines Co. This is a non-tipping body type, with a reversible mechanism. The drive, used while transporting the mix, tends to throw the concrete to the front end of the body, and the reversible mechanism is used to unload the mix as it throws the mix to the discharge end of the truck. The Ready Mixed Concrete Co., of Pittsburgh, is managed by J. E. Burke, who was recently elected president of the newly formed National Ready Mixed Concrete Association.

The Ready Mixed Concrete Co. confines most of its activities to Pittsburgh proper. However, transit-mixed concrete is also made in Pittsburgh by the McCrady-Rodgers Co., which has batching plans at Braddock, Hamstead, Wilkensburgh and Pittsburgh. It has 35 Paris transit-mixing trucks that range in capacity to from 3 yd. to 3½ yd., with the smaller size apparently being the favorite. At the sites mentioned the company has Blaw-Knox batching bins for loading the mixers. Sacked cement is used.

Two views of an ordinary tow for the steamer "E. K. Davison" of the J. K. Davison and Bro. Co., Pittsburgh, some 5000 tons

Barges

There are two types of barges in use on the rivers near Pittsburgh, the flush-deck type and the hoppered type. These hold from 500 to 650 tons of material each. The trend in barge construction is to build of steel throughout, with the exception of 4x8-inch timbers bolted to the wales, or top deck enclosure, to take the brunt of the blows of the unloading buckets. There is also a tendency toward doing away with the hopper-type barge entirely. Practically all of the more recently constructed barges are of the flush-deck type. This type affords better drainage, is easier to empty and clean, and particularly in the case of sand, a dryer product can be hauled, which means a greater load capacity. The flush-deck type can also navigate in shallower water. The newer steel barges on the river were either built by the Dravo Contracting Co. or the American Bridge Co., both having shipyards on the Ohio river near Pittsburgh.

Notes on Dredges

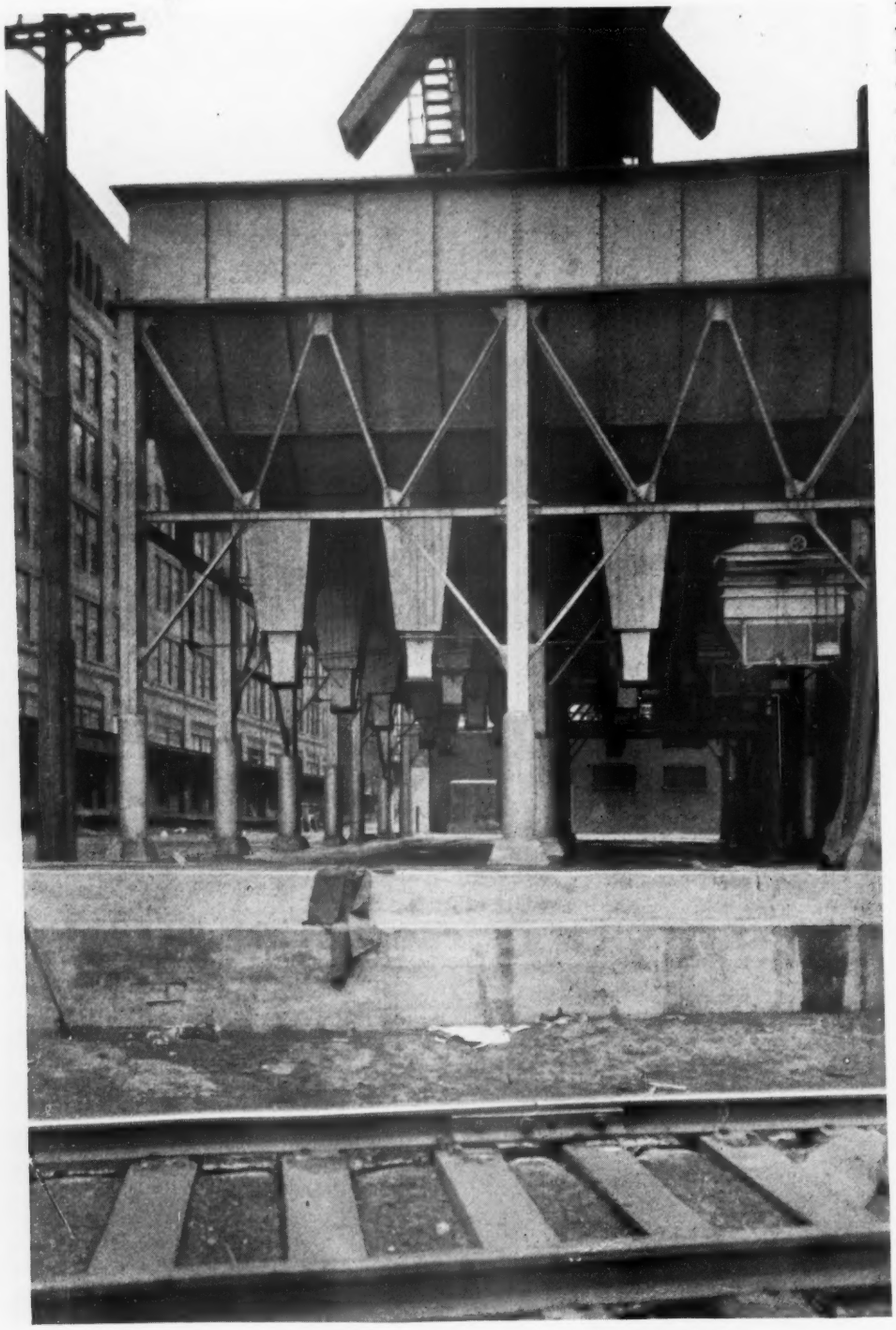
The use of rubber as a lining for chutes and launders has been adopted by all of the dredge operators in the district. The dredges of the J. K. Davison and Bro. Co. and those of the Keystone Sand and Supply Co. use a special ⅝-in. pure gum (no fabric) rubber liner that is vulcanized to the steel-chute bottoms. These liners have been in service for years, and in one case rubber that had been in service five years was still usable. The vulcanizing has in the past been done

by both the Goodyear and Goodrich rubber companies, and is usually shipped from the factories, steel base and all, to designs by the dredge owners. Where it is not feasible to use the vulcanized rubber liners, old rubber conveyor belts have been used for the same purpose to advantage and at savings over the cost of metal liners. One kink adopted by several of the operators is the use of discarded truck tires, which are cut and opened up to present a flat surface, in different places about the operation where metal is subjected to the abrasion of gravel. These old tires are also used as bumpers to protect the barges.

Dredges on the river are of two distinct types with reference to the digging ladder. One type uses the one-piece, cast-steel, cup type of bucket, with the cups connected to each other by a pin. The other type of bucket line is of the slack-line type; that is, the bucket line drags on the bottom somewhat, and uses larger buckets fastened to every other link of the digger chains.

Davison Operations

All of the dredges are equipped with a single rotary screen with the exception of the dredge *Allegheny*, of the firm J. K. Davison and Bro., operating on the Allegheny river, which has two parallel rotary screens. Last year the gravel elevator of this dredge was increased in height and two Hum-mer screens installed at sufficient elevation to make two products with these screens, which could be chuted and loaded to different barges simultaneously. The additional height was necessary to get the material to flow down the spouts. The dredge *Allegheny* is of the slack-line bucket type, of steel construction throughout, using "Tisco" manganese-steel buckets and links on the digging ladder and the two elevators. The digger ladder has 33 buckets, each holding 21 cu. ft., connected to every other link of the digger chain. The pins holding the links are peaned so that it is practically impossible for a bucket line to become disengaged. The operator figures it is much cheaper to burn off the pins with a torch when necessary than to take the chance of having to fish up the bucket line from the river bottom. The pins cost about 60 cents each and repairs are not often necessary. The digging ladder is raised and lowered by a Lidgerwood hoist, direct-connected through enclosed gears to a 50-hp., armored Westinghouse electric motor.



Batcher bins and loading spouts in the south yards of the Keystone company at Pittsburgh

Recently the hull of this dredge was lengthened to 200 ft. by the addition of pontoons at the front or digging end. This gave it greater buoyancy and incidentally made it the largest digger on the river in that vicinity. It has a width of 45 ft. and a draft of 7.5 ft. The dredge was built in 1921 by the Goodman Engine and Machine Co., Pittsburgh, after designs of the company, and is provided with electric motor drives and separate controls for all of the different operations. The rotary screens were built by the same company which built the dredge, using W. S. Tyler Co. cloth and Taylor-Wharton rings and tires. Two 300-hp. Heine water-tube boilers, coal-fired, supply steam to a 500-hp. Kerr turbine, that is connected to a General-Electric, direct-current generator. The turbine operates at 3600 r.p.m. and drives the generator at 900 r.p.m. through a Kerr speed reduction unit. There are 22 different direct-current motors on the dredge ranging in size from 250-hp. to 1-hp. The largest motor is used on the digging ladder. Both General-Electric and Westinghouse motors are used.

The two main screens are 38 ft. long and have inner barrels 84 in. in diameter, with jackets 8.5 ft. outside diameter for most of the screen's length. The gravel from the rotary screens falls to a well and is elevated by a bucket elevator similar in design to the digger ladder except it is of smaller capacity and rigidly mounted. This elevator has 21 buckets holding 11 cu. ft. each, and discharges to the vibrating screens previously referred to. The sand from the jacket is chuted to a separate well and is picked up by a second bucket elevator and chuted to the barges. Only one kind of sand is produced at a time. This sand practice seems to be universal on all the dredges. There are four spuds to hold the dredge while digging, which are raised and lowered by separate electrically powered winches.

The dredge is maintained at a high degree of mechanical perfection at all times and is one of the largest producers on the river. Neat and well-kept quarters are provided for the crew of 22 men. Incidentally, the dredge does not have a captain, but is in charge of three operators; one operator on the night shift and two on the day shift, with one of the operators looking after repairs and the other the digging and screening operations. Their operations are directed by George H. Williamson, who has charge of all the production operations of J. K. Davison and Bro.

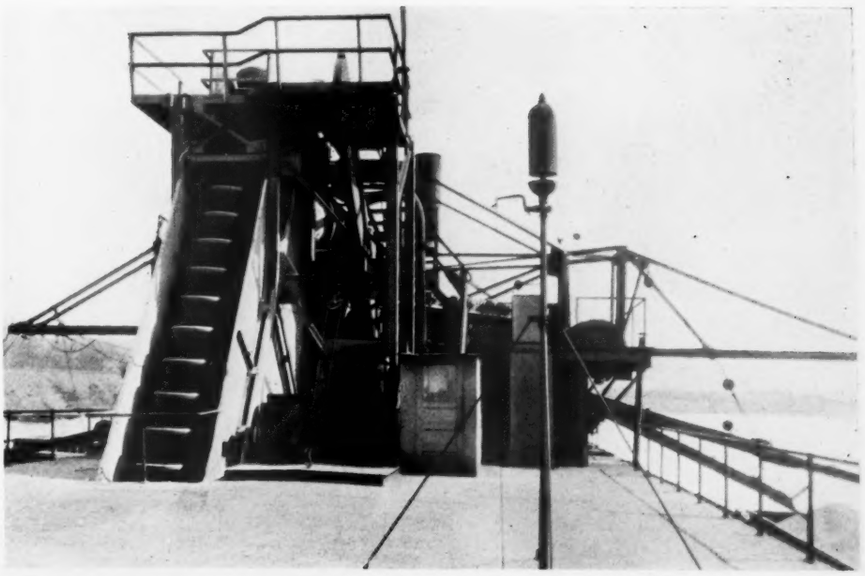
Besides the dredge *Allegheny* the company has a second digger that is kept as an extra or for use in the production of special sizes. Other floating equipment of the company consists of 48 barges and two towboats.

Keystone Sand and Supply Co. Operations

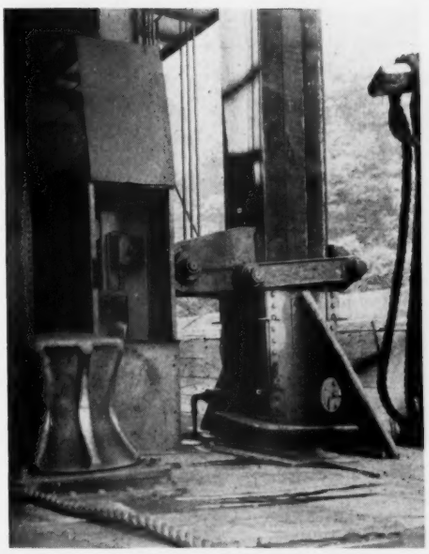
This company is the youngest of the four producers at Pittsburgh but one of the most progressive. The company started its first digger with a capacity of about 100 tons per hour in 1909. Its present digging capacity with three dredges is 10 to 20 times that tonnage.

At the time of my visit (July) the company had two dredges in operation, a third being held in reserve. These dredges are No. 4, No. 8 and No. 9, the No. 4 being the one in reserve. They are all of steel construction throughout.

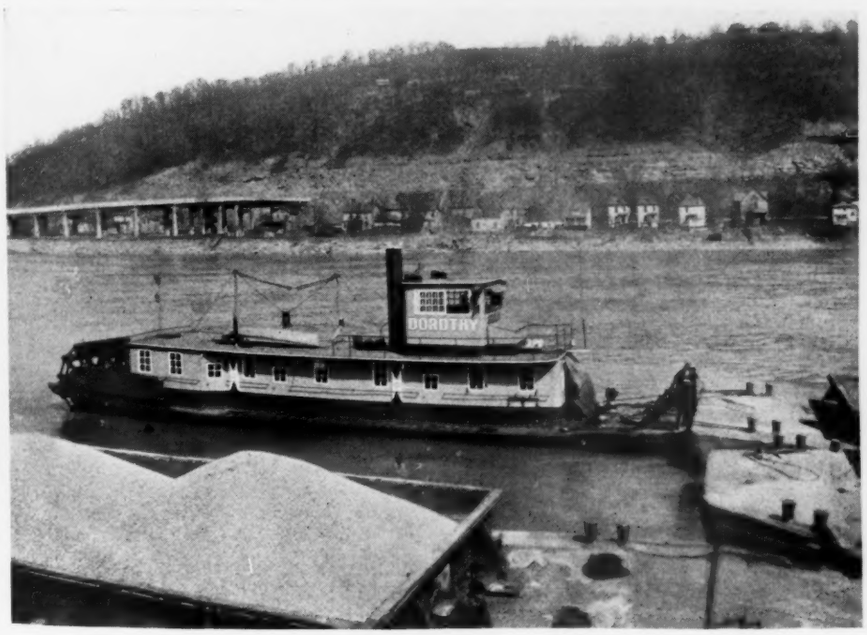
Early in July dredge No. 8 was reclaiming gravel from the cofferdams that were a part of the construction work on Neville Island, incidental to the construction of a marine way for the Dravo Contracting Co. Dredge No. 9 is the company's main producer, and at present is operating about 30 miles from Pittsburgh on the Ohio river. The dredge was built by the Dravo Contracting Co., as were all the dredges of the Keystone Sand and Supply Co. It has the cup type of buckets connected together by pins. The dredge is the only one on the river that can make and load four sizes of material at one time, and this is a feature that permits of a higher percentage of actual loading time and one requiring a minimum of time of towboat service. All the launders are rubber-lined, and any unwanted smaller sizes can be chuted back to the river via an 8-in. rubber hose. Oversize from the rotary screens passes to the river through a different well or chute.



One of the secondary bucket lines on a Keystone dredge



At right, spud lifter on the dredge "Allegheny." Each spud has a separate electric motor and control



Typical towboat showing method of pushing barges

The digging ladder on No. 9 has 85 cast steel cups each holding 4 cu. ft. and can dig to a depth of about 50 ft. The buckets dump at the rate of 31 per minute. On this basis and assuming the buckets are full, the dredge can dig between 400 and 450 tons per hour. The digging ladder and other equipment is driven by a 120-hp. Skinner Uniflow steam engine, while the four spuds are each raised and lowered by a 6x6-in. Osgood steam hoist.

The company has 84 steel barges that hold from 500 to 650 tons each. The barges are all of the flush-deck type and are provided with drainage ports so that excess water returns to the river. The barges being used in Keystone operations were built by the Dravo Contracting Co.

The Keystone Sand and Supply Co. has, strictly speaking, four towboats for its own use and two others that are used jointly by the sand company and the Dravo Contracting Co. In addition to these six towboats that are available, there now are under construction two 75-hp. Diesel-driven towboats that probably will be used jointly by both companies. The oldest towboat of the Keystone company is the *Victory*, a steam-

Keystone company crane which can discharge to the pits shown or to hopper serving conveyor over railroad tracks

driven stern-wheeler. In fact, all of the boats of the company are of this type, no propellor types being on the river in the sand and gravel field. All of the other boats of the company are driven by Diesel engines. The *Virginia* is driven by a 100-hp. Fairbanks-Morse Diesel engine. This towboat and its sister, the *Martha*, are the ones used jointly by the Keystone Sand and Supply Co. and the Dravo Contracting Co. The *Betty* and *Mary Alice* are the names of the two remaining towboats. The *Betty* was built in 1928 and is powered by two 240-hp., Fairbanks-Morse, Diesel engines and has practically the same type of drive as the *Mary Alice*, which was placed in operation this year.

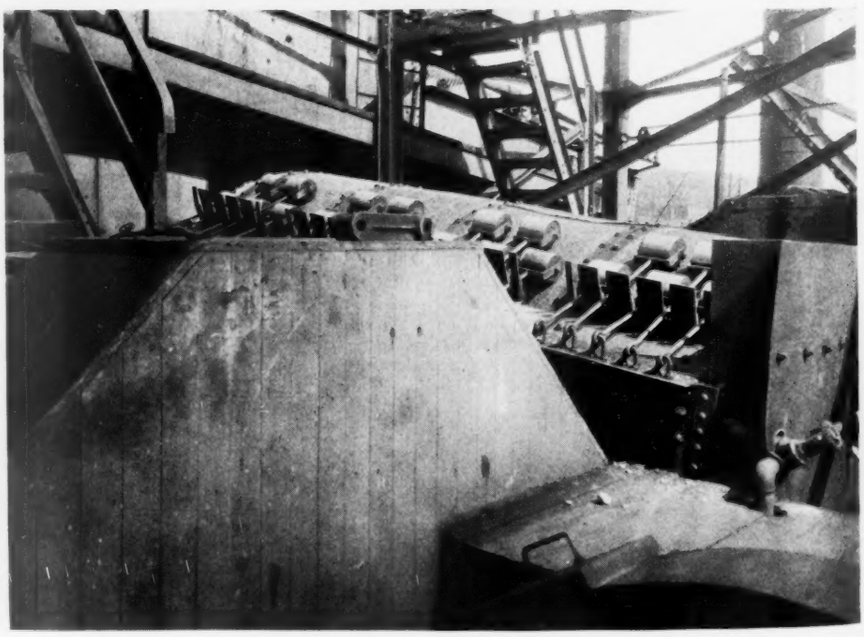
The *Mary Alice* is powered by two 290-hp., 6-cylinder, New London Ship and Engine Co. Diesel engines, each direct-connected to the fan tail by an extended shaft, pinion and gear. The fan tail of this boat and of the *Betty* is in two parts, each half being served by one of the 290-hp. engines. This boat can push six barges or 3000 tons net load to Pittsburgh from where dredge No. 9 is now working in about eight hours. In quiet water it can make 10½ miles per hour.

The boat is provided with neat sleeping quarters for the crew and captain, washrooms, toilets, Kelvinators for drinking water, and a General-Electric refrigerator serves the galley. Air at 350 lb. pressure for starting the Diesel engines is secured from two style 20, Ingersoll-Rand compressors, one compressor being driven from each extended shaft by a Texrope drive. A 30-kw. Fairbanks-Morse generator, connected to a model 40 gasoline engine of the same make, supplies electricity for lights. L. C. Laymon is captain of dredge No. 9 and Capt. Cramer has the *Mary Alice*.

A portion of the identical site that Washington is supposed to have chosen for a fort is now one of the distribution yards of the Keystone Sand and Supply Co. At the extreme end of the point is a small park only a few hundred square feet in area, and adjoining this park is the distribution yard operated under the name of the Inland Dock and Wharf Co. While the dock is thus named, it is operated by the sand company and primarily for its business, but the dock can be used for loading and unloading coal, etc. The barges here are unloaded by a Dravo reclaiming shovel that discharges to concrete pits for bulk storage or to a series of parabolic steel bins for truck loading.

The yard is intended for truck and Barrymore transit mixer distribution, although the company does not operate the latter feature in downtown Pittsburgh. It has, however, two Barrymore transit mixers in operation at Coraopolis, one of the industrial suburbs of Pittsburgh. At "the Point" yard both Blaw-Knox and Johnson batchers are provided. These batchers and the

The "Point" distribution yard of the Keystone Sand and Supply Co.



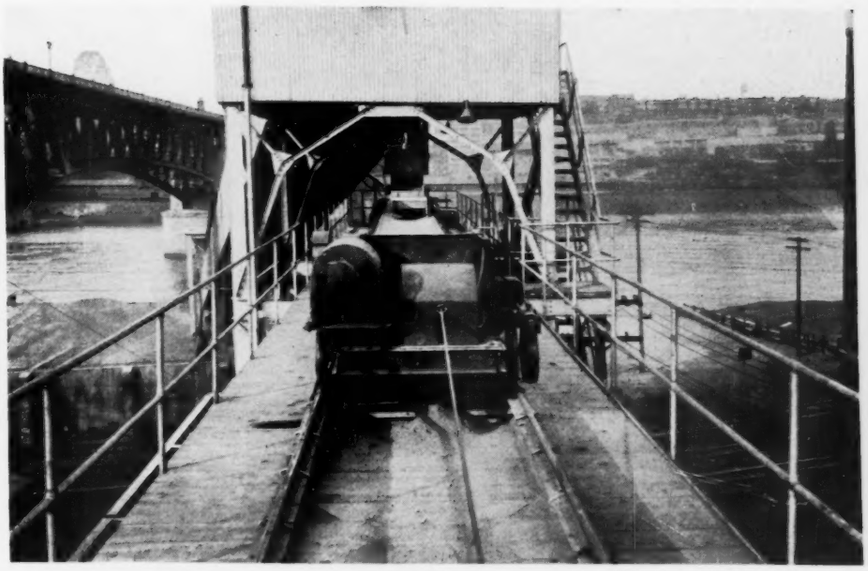
Beaters which prevent the fine screens from clogging at Keystone plant

parabolic bins are provided with steam coils so that heated sand and gravel can be sent out during the winter months. One is impressed by the neat and orderly arrangement of the entire yard with its landscaped turning area, neat scale house and even the design of the bins themselves.

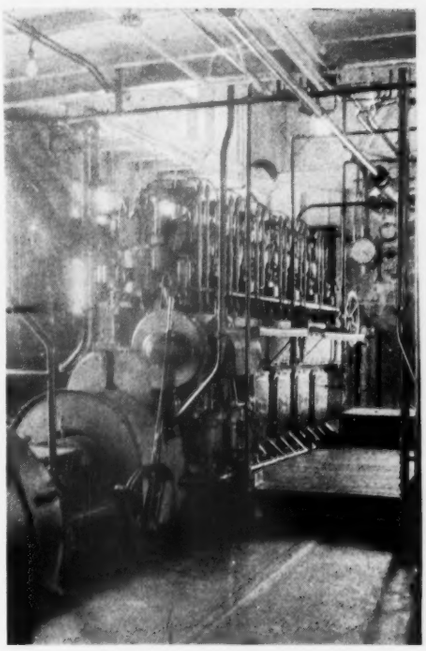
At the south-side yard, the other main distribution yard of this company, larger and more pretentious facilities are provided for truck dispatching. This yard, too, serves the center and industrial section of the city and is provided with a Dravo crane and a 3-yd. Blaw-Knox bucket that unloads the barges to concrete pits. The pits rest on piling on the banks of the Allegheny river. These pits hold in the neighborhood of 30,000 tons. The crane can discharge the material to the pits or to a hopper serving a 36-ton Robins conveyor that carries the material over the tracks of the Pittsburgh and Lake Erie railroad to a shuttle conveyor serving the trucking bins. These bins are also of parabolic construction and provided with Blaw-Knox batchers for truck dispatching. For transit mixing the cement is handled in sacks from the cars and can be dumped to the boot of an elevator to the batcher feed hopper or stored on the warehouse floor.

The sand and gravel in the parabolic bins is kept warm in winter months by live steam and some of the bins are provided with an additional jacket that surrounds the bins and in which are banks of steam coils.

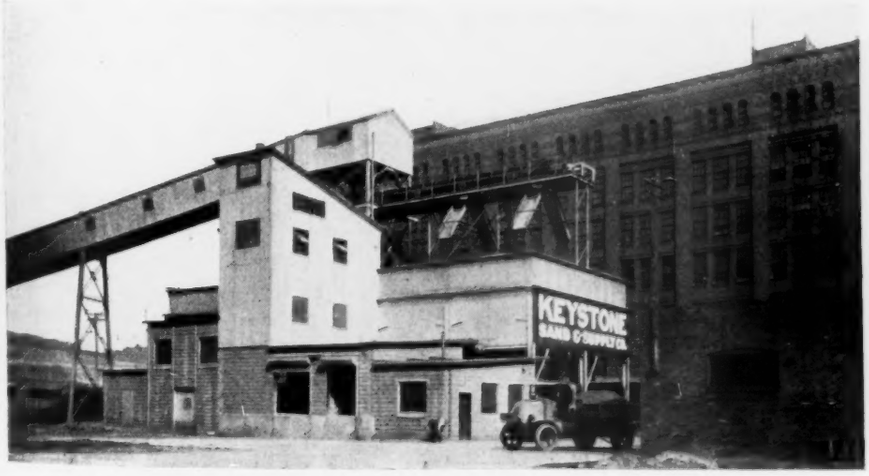
Tests have been made by this company of the gravel and sand in the harbor of Pittsburgh. By the harbor of Pittsburgh is meant that area confined within the locks of the three rivers, the Ohio, Allegheny and Monongahela. The gravel that remains in the harbor is the leavings of previous dredging operations and is mostly of large size. A large part of this gravel would have to be crushed and it is contaminated with rubbish, coal, scraps of wood, etc., but at some future time it may be necessary to work these deposits. Undoubtedly there is a large tonnage which by proper washing and treating can be made available. This material is deficient in sand. The dredging operations of this company are now 25 to 30 miles down the Ohio river and daily becoming more distant, and it may soon become more economical to work the nearby deposits, despite their handicaps.



Shuttle conveyor serving the trucking bins at Keystone south yards, Pittsburgh



At right, one of the two Diesel engines which furnish the power for the towboat "Mary Alice" of the Keystone fleet



The south yards of the Keystone Sand and Supply Co. at Pittsburgh

The company has six other distribution yards at strategic points on the river, in addition to the two just mentioned, that are equipped for truck, rail and water shipments, and three other yards that are for truck shipping only. The yards all have Dravo cranes, batcher bins and ample ground storage.

Iron City Sand and Gravel Co. Operations

The Iron City company has three dredges in operation on the lower Ohio, but close to Pittsburgh. The largest of these is the Diesel-electric *Elizabeth Pfeil,* which is referred to in connection with the advertising. It was described in detail in Rock Products, August 23, 1924. This dredge is unique and differs from any on the river in that it has a crusher mounted on its deck for reduction of the oversize. At present a 10x40-in. Good Roads jaw crusher is used, Texrope driven from a 50-hp. Allis-Chalmers induction motor. The crusher has a corrugated jaw and is set to deliver a 1½-in. product. The crusher has a capacity of 80 tons per hour, and is said to be crushing about 80% of the plus 2¾-in. material, with which it is fed. The crushed material falls to a small elevator that passes the material to a separate small rotary washing screen, which discharges its product to the barges along with the same sizes of uncrushed material.

McCrady-Rodgers Co. Operations

The McCrady-Rodgers Co. is the name of the company formed by the merging of

the former Rodgers Sand Co. and McCrady Bros. The Rodgers Sand Co. was one of the oldest producers of aggregate in Pittsburgh.

This company's dredge *Captain* is of the same type and size as No. 9 of the Keystone Sand and Supply Co., being built by the Dravo Contracting Co. at about the same time that No. 9 was built. This dredge operates on the Ohio river a few miles above Rochester, Penn.

Up-the-River Operations

So far this letter has dealt only with the gravel producers who might be said to operate at Pittsburgh. Other operators of dredges on the lower Ohio and upper Allegheny rivers are the West Penn Sand and Gravel Co., which has two wood-hulled digger dredges; one, the *National,* is in operation near Rochester and serves that town and other smaller towns on the lower Ohio. No serious attempt is made by this company to tow into Pittsburgh proper, although it has floating equipment that could be used for that purpose if expedient to do so. This company has offices in the Oliver building, Pittsburgh.

Farther up the Allegheny river, near Kittanning, Penn., the Allegheny River Sand Corp. has two small digger dredges in operation. Its dredge No. 2 is operating about a mile above Kittanning and is supplying sand mostly. The barges of sand are towed to a shipping station on the Pittsburgh and Shawmut railroad, where the barges are unloaded by a 1¼-yd. McMyler-Interstate steam crane. The main source of gravel, however, is from the other dredge operating at Reesedale, about 12 miles above Kittanning on the river. The dredge at Reesedale is a digger with a wood hull, a steam-driven boat, but has no washing equipment on deck. All the sand and gravel is chuted from the digging ladder to barges, which are towed to a land plant a short distance away. Here the gravel is unloaded by a Wiley Whirley (Dayton Whirley Co.) or a Link-Belt crane. The former is also used for reclaiming from the ground storage.

The dredge "Allegheny" of J. K. Davison and Bro., operating about 30 miles above Pittsburgh

Type of digger buckets on the dredge "Allegheny" of J. K. Davison and Bro.

The gravel from the cranes discharges to a hopper served by a Telsmith reciprocating pan feeder, that in turn serves a rotary grizzly, the oversize from which falls to a No. 37 Kennedy-Van Saun gyratory crusher. The fines from the grizzly and the crushed product pass by a belt conveyor and bucket elevator to a washing screen, with the oversize chuted to two No. 25 Kennedy crushers. The discharges from these two crushers join and return to the rotary screen. The sand from the rotary screen jacket passes to a Kennedy-Van Saun rake classifier, that discharges to a belt conveyor serving a ground storage pile. The gravel from the rotary screens falls to a bucket elevator that discharges to two Hum-mer vibrating screens mounted over the steel parabolic bins that serve as loading bins. The plant was built for the company by the Link-Belt Co., which supplied the elevating and conveying equipment.

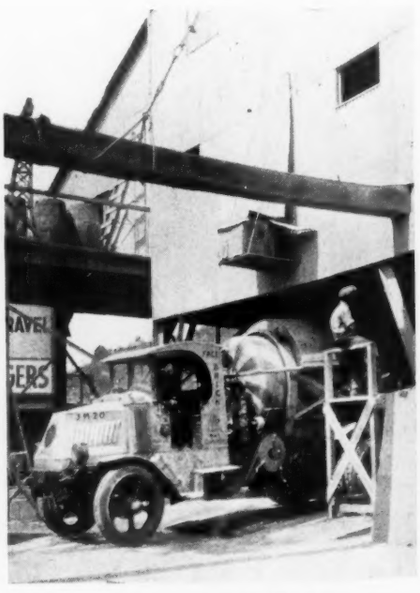
Aside from the fact that the plant is located on land and served by the barge fleet, differing in this respect from any on the upper rivers, the use of specially designed tail pulleys for the conveyors and bucket elevators is a feature of the plant. These pulleys are of cast steel and have a face so designed that it is impossible for any gravel to get between the belt and the pulley face. The pulleys were supplied by Sprout and Waldron Co. and are said to be very satisfactory, with no excessive conveyor belt wear due to the fluted nature of the pulley face.

The company has eight steel barges and a similar number of wooden barges. The former hold 150 tons and the latter 125 tons each. Other floating equipment consists of two towboats; the *Wilber* uses a 75-hp. gasoline engine and the *Valley Green* has a 60-hp. Superior semi-Diesel engine for motive power. The plant has a capacity of 800 tons per day.

Oil City Sand and Gravel Co. Operations

Capt. C. A. Smith, vice-president of the Oil City Sand and Gravel Co., formerly with J. K. Davison and Bro., of Pittsburgh, about three years ago purchased a second-hand digger dredge and installed it on the river at Oil City. He started out, one might say, on a "shoestring," but his efforts and his industry are being rewarded by a gradually growing business. He is at present shipping eight to ten cars of material per day and expects that he will shortly have to increase his capacity to about twice that amount. He has the distinction of operating a dredge at the highest point on the Allegheny river, as all gravel production on the river above Oil City is by other methods than dredging.

The company has three steel and three wood barges, which are towed to their yard in Oil City by a small gasoline-engine-driven boat. The barges hold 125 tons. The barges are unloaded to ground and bin storage by



One of the McCrady-Rodgers Co., Pittsburgh, transit mixers operating out of the north side distribution yards of that company

an Erie steam crane. Shipments from the yard can be made over the New York Central, Erie, and Pennsylvania railroads, a feature that has contributed greatly to the success of the enterprise. Truck shipments are also made from the yard.

At the time of inspection a No. 4½ Champion jaw crusher was being installed at the yard for the purpose of filling a special order requiring a certain percentage of crushed gravel. The installation is only temporary, but may later be made a permanent feature of the operation. Recently the company purchased a new gasoline-driven 1¼-yd. Industrial Brownhoist crane for reclaiming from ground storage.

Apparently the general public in Oil City does not appreciate the good that a digger dredge can do them in the way of assisting the opening of water transportation, but instead has surrounded the owners of the Oil City Sand and Gravel Co. with several useless laws, one of which prohibits the dredge from operating after 8 p. m., presumably on account of the noise that it is supposed to make.

Belgium Feels Tariff

BELGIUM cement manufacturers report a decided slackening in both domestic and foreign orders, according to Walter S. Reinecke, American consulate general at Antwerp. Construction activities have slowed down and building permits are less than they have been for the last five years. The drop in exports, especially to the United States, is keenly felt by Belgian cement producers and the eventual loss of the American market through the application of the duty on cement entering the United States would be a hard blow to the Belgian industry.

Automatic Sand Dewaterer

A TYPE of sand dewaterer which has been used for years in the South African mining fields is illustrated in the *Engineering and Mining Journal* of recent date. It uses the Dowsett hydraulic control, a patented device. The main feature of this control is the valve hung from a diaphragm which is shown in the lower part of the illustration. So long as a thick pulp flows out of the cone there is no pressure on this diaphragm. When water rushes out it presses up against the diaphragm and closes the valve, allowing the sand to collect in the cone until only a thick pulp issues.

In the original article several important descriptive features were omitted and the inventor has supplemented the data with more information from which the following is abstracted:

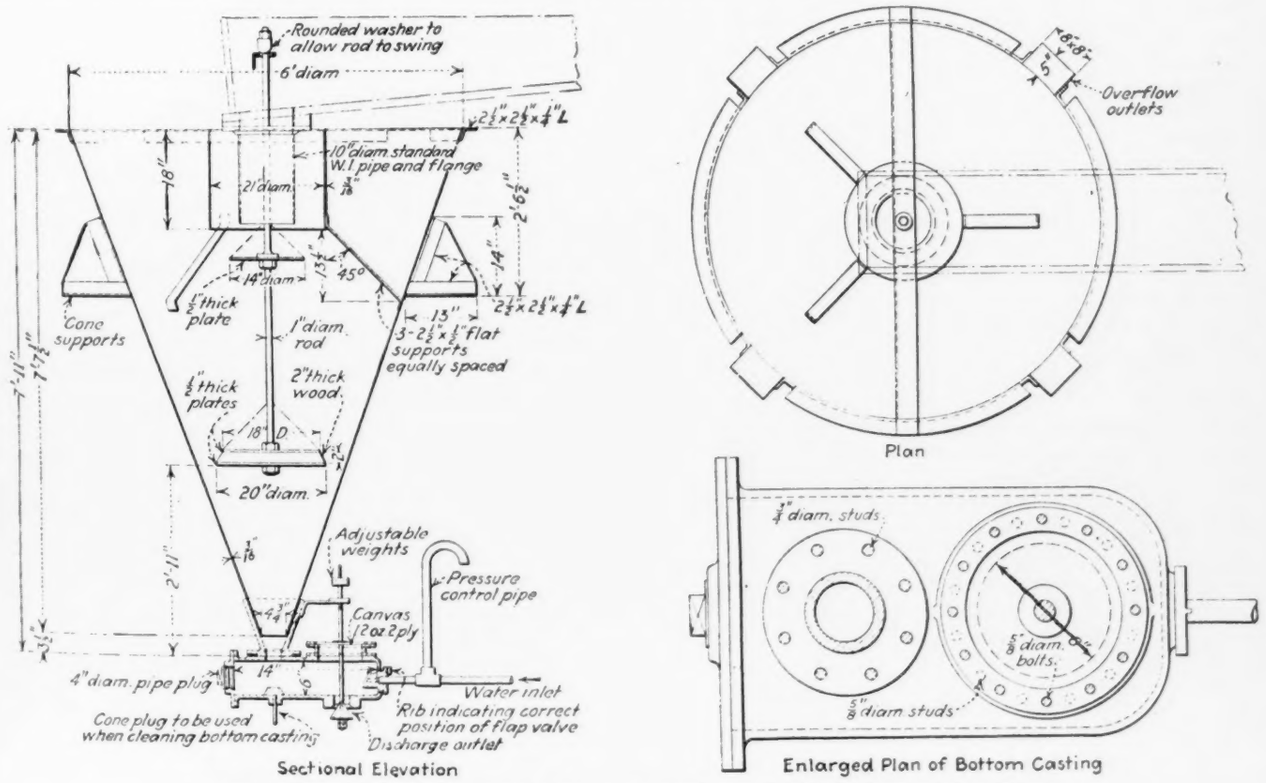
Two points are noted as essential to the proper working of the machine, the swinging diaphragm in the body of the cone and the water service of the discharge mechanism. The swinging diaphragm tends to insure an even flow of sand to the outlet. When there is more settled sand on one side of the diaphragm than the other, the diaphragm swings away, allowing the heavy sand to flow to the outlet.

The passage of the sand (which is like a mush, in the quicksand stage) through the box at the bottom is attended with considerable friction. A trickle of water from the water service pipe lubricates it sufficiently so that it flows out steadily with normal runnings. This water service pipe has a short vertical open pipe connected about one-third the height of the cone, so that the water pressure cannot rise beyond a certain point. There is a flap valve in the service pipe that closes when the pressure passes this point.

If the pressure increases in the discharge box the flow of water from the pipe is shut off by this flap valve and if it continues to increase the pressure acts on the canvas diaphragm and *closes* the sand discharge valve. While the sand builds up in the cone this discharge remains closed, but a leakage around the valve gradually releases the pressure on the diaphragm, allowing the valve to open and the sand to flow normally.

The discharge closes with a jarring effect that is said to bring down any sand that adheres to the side of the cone. The inventor says that the cone will operate without any attention for a month. When the canvas diaphragm is to be changed, the conical plug below the cone outlet is pushed up to close the outlet, thus avoiding running out the contents of the cone.

This cone has been used for years in South Africa as a classifier and dewaterer and has lately been installed in Canadian plants. So far as has been learned it has not been tried out in the rock products industry.



Elevation and details of sand dewaterer popular in South African mining fields

Two typical views of operations, the one at the left, looking across a quarry toward the crushing plant and the other, looking from the plant across the quarry

Study of a Group of Crushing Plants in the Central West

Part I—Introduction and Outline

By Earl C. Harsh
Associate Editor, Rock Products

MOST of the published information about quarry and crushing plant operation is in the form of descriptions of specific plants—often of new plants which have not operated long enough to have the kinks ironed out. This series of articles will be different, for a real effort has been made to study and describe and discuss, not one operation, but a whole group of operations. This group operates in limestone of various kinds and under comparable conditions, so far as conditions in quarry operation are ever comparable.

An effort has been made not merely to describe the operations but to discuss the methods, pro and con, of the different operations, from the point of view of one experienced in quarry and crushing plant operation and plant design. No attempt was made to pick out what one might consider "the best" operations. They were taken as they came. They include plants under various ownership and management. For obvious reasons, because of the way the subject is treated, no reference is made to any plant by the name of its location or company ownership. Such views as have been used for illustration are designed merely to show some feature of operation, not to identify the operation.

The group studied includes some thirty plants with a total annual output of around nine to ten million tons of commercial crushed stone of the various sizes. Most of the product goes to concrete aggregates and road material, with some to ballast.

A screening plant with balanced skips to elevate the crushed stone

Ranging all the way from 4000 tons per day down to 600 tons per day output, the various plants are operated with crews of from 60 men down to 15 men, with an average output of around 50 tons per man per day.

The various plants show in an interesting way the change and growth of the crushed-stone industry. Some of the operations were begun 30 or 35 years ago, and a few of the plants now operating are 20 to 25 years old, but the equipment has been changed or added to in such a way as to effectively meet the changing and growing demands upon the industry as the use of stone increased and specifications became tighter. Some of the plants have been rebuilt or were built new during the past 10 or 15 years, and these have been modified and changed to some extent. The older plants are for the most part of timber construction with timber bins resting on concrete walls, while the more recent plants are of steel construction with reinforced-concrete bins. Of the group about 30% are of steel construction.

Among the changes which

A typical crushing and screening plant showing detached truck loading bins

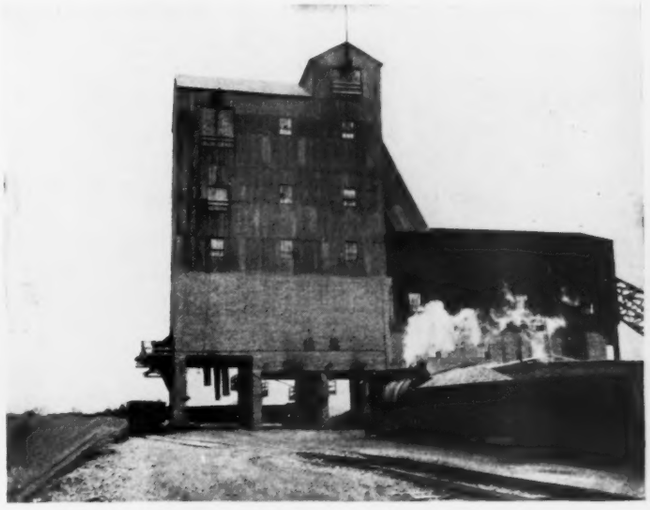
Showing truck loading bins, left, rail loading, center, and quarry incline, right

have been made is the gradual conversion of the power from steam to electric. The original plants were of course all steam-engine driven, but the plants built or rebuilt in recent years have been arranged with electric motor drives, using several motors, or individual motors for each machinery unit, while at a few of the older plants a single motor has been put in to replace the steam engine. Belts and pulleys for driving the various units have been largely replaced by enclosed gear reducers. With one or two exceptions, 3-phase, 60-cycle, 440-volt current, purchased from the local utility companies is used at all the plants. Even those plants which are

An example of an old plant to which has been added a washing plant of steel construction

Here the crushing and screening plant has been built on the edge of the quarry and extending into it

Showing a modern type of plant constructed of steel and concrete and using an incline from the quarry



An old operation which has been entirely rebuilt of concrete, with bins of masonry

in part steam driven use electric power for operating pumps, air compressors, vibrating screens and lights.

The newest and most modern plants are arranged with individual motor drives with speed reducers or Texrope belts for each machinery unit. A few are arranged with push-button starters located in one place and electrically interconnected so that they may be automatically started in sequence, and so that they will also automatically stop in the reverse sequence in case of failure of any unit or motor.

The various plants thus show every type from the older steam driven plant to the most modern individual motor-driven plant, and with equipment ranging from the older revolving and shaking screens to the modern vibrating screens.

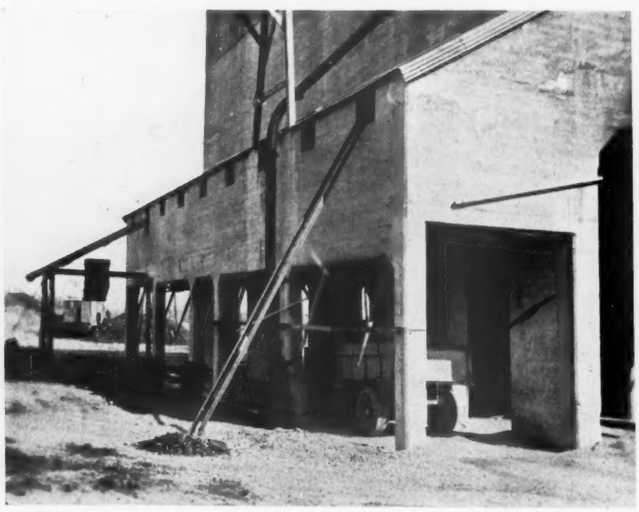
To meet the increasingly strict specifications for clean stone, washing of at least part of the sizes is now being done at 60% of the plants in this group; 20% of them washing all sizes, and 40% washing those sizes smaller than 1-in. No washing is done at the remaining 40% of the plants studied.

At most of them the method of washing has been worked out so as to utilize the existing equipment, and consists in spraying clean water on to the stone as it passes over the screens and then collecting the fine material and dirty water into a flume in which it flows back to a settling reservoir.

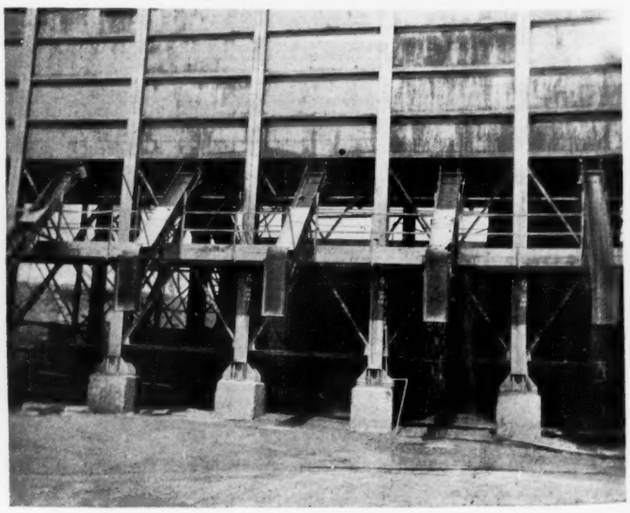
Quarry and crushing plant showing loading tracks and track leading into the quarry

Where primary crusher is located in the quarry and crushed stone is carried by conveyor belt to screens

Another view of a rebuilt plant. Incline from the quarry can be seen at the left

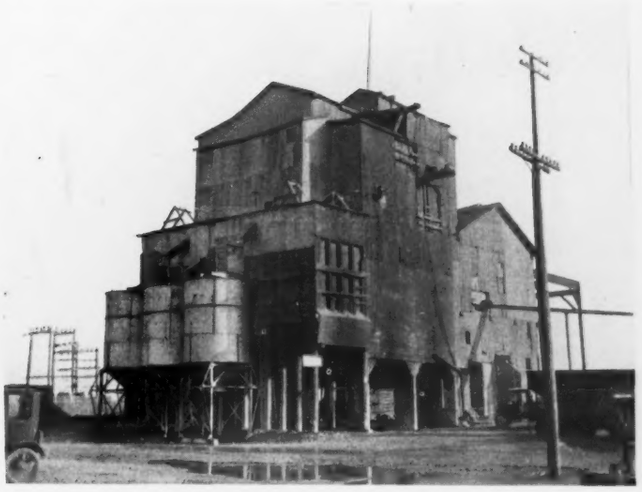


An example of truck loading facilities for all sizes of crushed stone



Type of steel bins used at on plant for loading cars and trucks

A modern steel and concrete plant which washes all sizes



Picture shows additions made to this plant from time to time

A corner of the quarry or an abandoned quarry hole is utilized whenever possible to settle out the wash water so that it may be used over again. The water for washing is furnished by centrifugal pumps with direct-connected induction motors. At one of the plants a rotary scrubber is used for the first washing, followed by spray washing of the various sizes as they pass over the sizing screens, but unless the quarry contains mud seams, jet washing is used and is sufficiently satisfactory, particularly when the water is used under a goood pressure.

The increasing demand for more of the smaller sizes has necessitated the addition of recrushers and additional screening equipment at practically all of the plants from time to time, and as such additions and changes were naturally made in the simplest and most direct way without any very exact knowledge of what the future demands might be and with the idea also of avoiding so far as possible the rearrangement of any of the existing machinery units, a few of the plants have the appearance of complicated and involved screening systems. However, a study of the flow sheets shows that they are not so complicated after all, but give efficient sizing and flexibility of operation. This is brought out further on along with other phases of the operations under the subjects of "Stripping," "Drilling and Blasting," "Quarry Loading and Transportation," "Crushing and Screening," "Storage Methods" and "Quarry Pumping."

The most noticeable trend is the increasing use of electric shovels for loading in the quarry, the greater use of vibrating screens in place of revolving screens, and the extensive use of the cone type and other fine reduction crushers for recrushing.

The electric shovel, although of greater first cost, is more economical in the long run, and by reason of its freedom from boiler troubles, ease of operation, and convenience, is a much more ideal machine for loading rock than the steam-operated shovel.

For sizing and screening, the vibrating type screen has proven its ability to handle satisfactorily all commercial sizes of crushed stone, and by reason of its less first cost, less weight, less power consumption and smaller space requirements, is very generally replacing the revolving type screen.

Geologically, the various limestones are in several different rock formations and systems, ranging from the Niagara formation of the Silurian system up through the various Monroe formations to the Columbus and Delaware limestone of the Devonian system, but more than half of them are in the lower Monroe formation.

They of course vary considerably as to physical characteristics, color, appearance, etc.; one of the hardest rocks shows a hardness of 19.0 on the Brinnell machine, a toughness of 15.0 on the Page impact machine, and an abrasion loss of 3% in the Deval test, with a porosity below ½%.

(To be continued.)

An attractive modern plant office

Government Reports of Mineral Resources for 1927

BOUND VOLUMES of "Mineral Resources of the United States—1927" are now available from the U. S. Department of Commerce, Bureau of Mines.

Of particular interest to the rock products industry, are the chapters on sand and gravel, cement, gypsum, stone and the lesser minerals. Following are some of the general production figures taken from these reports.

In 1927 the sand and gravel industry showed an 8% increase in production with 4% increase in value of the product over 1926, there having been 197,454,269 short tons mined, with a value of $115,529,786.

The cement industry surpassed all previous production records in 1927, there having been 173,206,513 bbl. manufactured, an increase of 5% over 1926. There were 171,-864,728 bbl. shipped, with a value of $278,-854,647, an increase of 6% in quantity and 0.3% in value over the preceding year.

Production of stone was 10% greater in 1927 than in 1926, with an increase of 5% in value.

The gypsum industry, because of the continued diversification of product, has more than doubled its production in the past ten years. However, there was a slight decrease in both production and value in 1927 under 1926.

Lime, silica, magnesite and feldspar production and value declined slightly in 1927, while fullers earth and talc increased.

In addition to production figures, these reports include export and import data, market and price information and general information concerning the various industries.

These reports are published in two volumes, Volume I including the metal mining industries and Volume II the nonmetallic mining industries. Copies may be obtained from the Superintendent of Documents, Washington, D. C., and are $1.25 and $1 respectively.

Comparison of Balls and Cylpebs As Grinding Media

In the Finishing Compartment of a Compound Cement Mill

By K. Koyanagi
Chichibu, Japan

MANY SORTS of grinding bodies such as balls, cylpebs, helipebs, ovalpebs, cubes and so on are now used in the finishing compartment of the compound cement mill. The writer has made comparison of the grinding action of small steel balls and cylpebs.

Two compound mills of the same size (Allis-Chalmers compeb mills of 7 ft. dia. by 24 ft. length) were filled with the same quantity of steel balls in the first compartment and the same quantity of small balls vs. cylpebs in the finishing compartments. A cement clinker of the same quality was charged to these mills, and the grinding action of both kinds of grinding bodies has been compared over an extensive period.

It is well known among cement manufacturers that by using only small steel balls as grinding media in the finishing compartment of the compound mill, cement can be ground only to a certain degree of fineness, beyond which point it is very difficult to go, although the clinker charge be made smaller. This comes from the cushioning action of the cement, which sticks to the grinding bodies beyond a certain degree of fineness, and covers their total grinding surface. The cement which once sticks to the surface of the balls comes off continuously and mixes in the finished cement in the form of small cement flakes. So the amount of "sticking" cement can be found by measuring the quantity of these cement flakes. To measure the quantity of cement flakes, the following method was used: 25 g. of cement was sifted in a sieve of 4900 meshes to the square centimeter, and the residue was weighed. The residue was then rubbed with the finger on a watch glass, and cement flakes reduced to powder and sifted again in the same sieve and weighed. The difference of these two weighings gives the quantity of cement flakes in the finished product. The sample of cement was taken at the outlet of the two mills every hour, and the above sieve test was carried out. Fig. 1-Fig. 3 are examples of this sieve test. In the graph the percentage of residue was taken as the ordinate, and the testing time as the abscissa. The dotted lines show the percentage of residue before rubbing, and the full lines that of after rubbing. The distance between these two lines gives the quantity of cement flakes.

We can see in these curves that the cement which is ground by using balls as

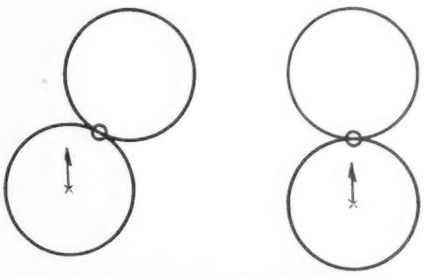


Fig. 4. Comparison of grinding action

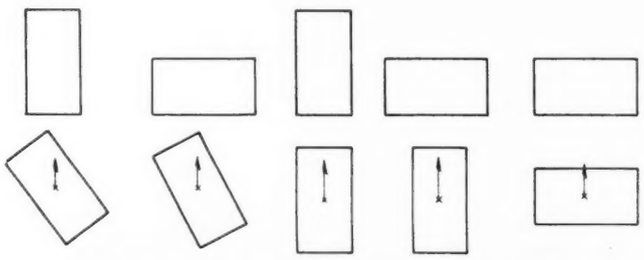


Fig. 5. Showing various examples of collision

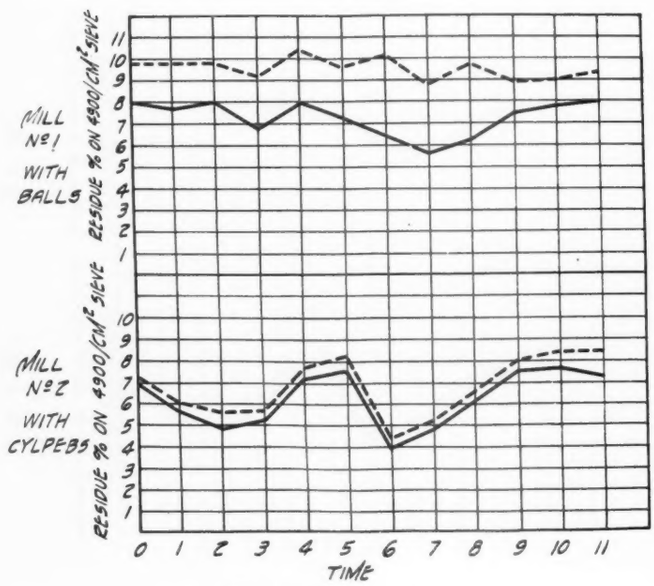


Fig. 1. Sieve test

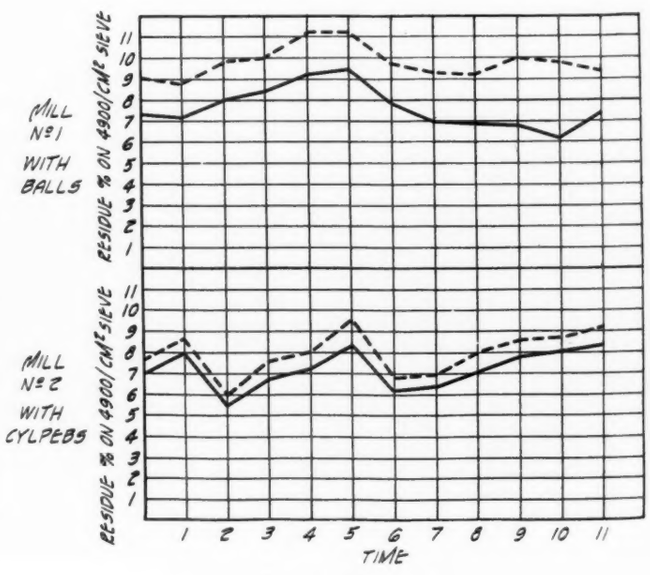


Fig. 2. Sieve test

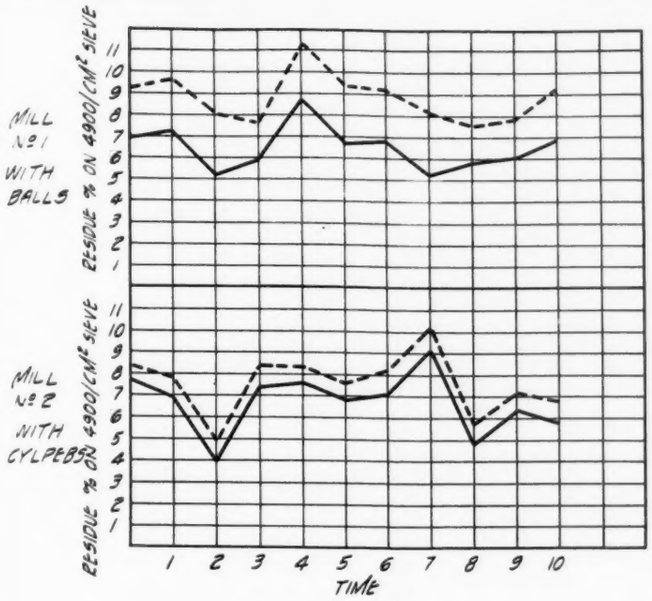


Fig. 3. Sieve test

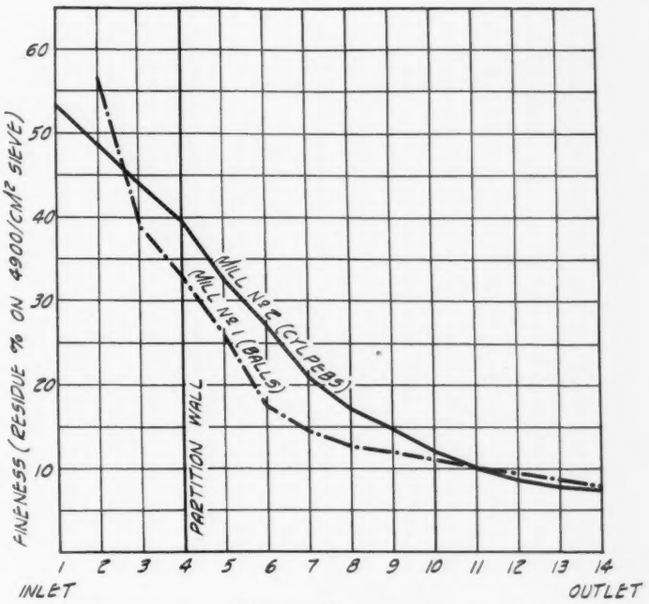


Fig. 6. Sieve test

grinding media contains much more cement flakes than the cement ground by using cylpebs. In the case of balls, the finer the cement is ground, the larger the quantity of the cement flakes. It means that the cement sticks more to the surface of the grinding bodies when it is ground with balls, than with cylpebs; and with balls the finer the cement is ground, the more cement sticks to the surface.

With cylpebs the quantity of cement flakes is comparatively small; moreover, it is not influenced by the fineness of the cement. In order to ascertain this fact, we opened the mills several times during the experiment and inspected the grinding bodies. The balls were covered with a thin layer of cement; the cylpebs on the contrary remained always quite clean.

Conclusions

1. *COMPARISON OF SHAPE*: Balls (spheres) have a greater surface area than the cylindrical part of the cylpeb (solid cylinder) of the same weight. For this reason the grinding power of the ball must be greater than that of the cylpeb.

2. *COMPARISON OF GRINDING ACTION*: The motion of the balls in the mill can be imagined as follows: the grinding action of balls is mostly carried out by collision, balls colliding with each other always on one point, as it is shown in Fig. 4, with their total or partial weight, and the stress at this point upon collision is so sudden and great that the thin layer of fine cement at the collision point has not enough time to escape, and is pressed into flakes which stick to the balls, covering the total surface in the meantime. Once covered with cement, it is natural that the grinding capacity of balls is remarkably decreased.

In the case of cylpebs the following five cases of collision can be imagined (Fig. 5). They collide with each other more in a straight line or plane, they collide on one point but seldom with their total weight. Besides it is likely that the grinding action of cylpebs is carried out mostly by friction, and the small quantity of cement which clings to them is constantly rubbed off, so the grinding surface is kept clean.

For this reason it is probable that the grinding capacity of balls, though it is larger than that of cylpebs, is rapidly reduced by the cement which sticks to the surface of the balls, and on account of this the balls show the worse result in grinding.

This supposition can be readily proved by the following experiment: The above two mills were, during the grinding test, suddenly stopped and opened. Samples of cement were taken at points every 20 in. in the mills, and sieve tests were made. Fig. 6 shows the results of these tests. In the diagram the ordinate shows the fineness, and the abscissa the points where cement samples were taken.

We can see from these curves that the grinding power of the balls is greater than that of the cylpebs until about 10 ft. from the partition wall, but is suddenly reduced afterwards, i. e., while cement is comparatively coarse, it doesn't stick to the balls and the balls show large grinding power, with increasing fineness cement begins to stick, and the grinding capacity of balls becomes suddenly less.

While the grinding power of the cylpebs is at first smaller than that of the balls, it remains always nearly constant, because the cement doesn't stick to them, so the fineness of finished cement is greater.

Pavement Designs Will Be Tested by U. S. Bureau of Public Roads

TO DETERMINE the relative efficiency of several designs of concrete pavements and to develop more exact knowledge of the amount and distribution of stress in pavement slabs resulting from loads applied to them in various positions, the Bureau of Public Roads of the U. S. Department of Agriculture is constructing numerous full-size concrete pavement slabs at the experiment farm of the department at Arlington, Va. The slabs will later be subjected to an elaborate series of tests.

Some slabs will be of uniform thickness throughout. Tests on these are expected to furnish information regarding the relation between loads applied at various points and the stress and strain of the concrete at all points in the loaded cross section, and the relation between load resistance and slab thickness.

Other slabs will be thickened at the edges and for a certain distance from the edges in accordance with the different designs now used in several states. In some slabs the thickening will be provided for by excavating the subgrade under their edges. In others the surface of the concrete slab will be raised at the edges so as to form a low, rounded lip curb. In still others the lip curb will be combined with a thickening of the edge of the slab at the bottom.

The test slabs, which will be 20 ft. wide by 40 ft. long, will have central longitudinal and transverse joints.

Other experiments will include bond tests of dowel bars to determine the length of embedment necessary; the measurement of subgrade friction, with particular attention to the effect of edge thickening of transverse joints on resistance to the sliding of the slabs on the supporting surface; and the measurement of the movement of the slab in the subgrade as a result of temperature and moisture changes.

Researches on the Rotary Kiln in Cement Manufacture

Part II.—Measurement of the Coal Consumption of Cement Rotary Kilns by Means of Analysis of the Exit Gases

By Geoffrey Martin

D.Sc. (London and Bristol), Ph.D., F.I.C., F.C.S., M. Inst. Chem. Eng., M. Inst. Struct. Eng., M. Soc. Pub. Analysts, F. Inst. Fuels; Chemical Engineer and Consultant; Former Director of Research of the British Portland Cement Research Association; Author of "Chemical Engineering"

IN MAKING portland cement clinker part of the carbon dioxide in the exit gases arises from the combustion of the coal and part from the decomposition of the carbonates in the material from which the portland cement is made.

It is possible by accurately analyzing the exit gases to estimate the coal consumption per 100 tons* of clinker made, without the necessity of weighing either the coal or the clinker. The carrying out of a kiln test, in which the coal and the clinker are actually weighed, is at most works a laborious operation. Consequently methods which obviate this necessity are valuable, since they enable the manager to check the fuel consumption of the kiln and control the work of his burners.

Savings of fuel to the extent of hundreds of tons a year could be effected in certain works merely by a rigorous control of the exit gas analysis followed by a computation of the fuel consumption per 100 tons of clinker made.

Methods of Computation

This may be achieved by several methods:

METHOD 1. The following method was devised by the writer: (1) From the analysis of the coal used on the works calculate the weight of CO_2 and N_2 evolved per 1 lb. of coal burned. (2) From the chemical composition of the dried slurry calculate the weight of CO_2 evolved per 1 lb. of clinker made. (3) By now assuming different fuel consumptions calculate the volumetric composition of the exit gas, and therefrom calculate the volume of air-free nitrogen for different fuel consumptions.

Then the fuel consumption is a function of the volume of the CO_2 per 100 volumes of air-free nitrogen in the exit gas, and by means of a table or curve the fuel consumption per 100 tons of clinker made can be read off for any given CO_2-N_2 ratio.

Now, in working out this formula there are a number of factors which cannot be estimated readily, which on the whole tend to make the practically found volume of CO_2 greater than the theoretical value. Thus the clay contains a certain amount of organic matter (humus, peat, woody fiber, etc.) which evolves carbon dioxide when burnt. The ash in the coal adds on to the weight of the clinker. There is a certain amount of sulphur in the coal which is partially estimated with the CO_2. There is a small amount of free nitrogen in the coal.

The net result of these factors is that when the actual fuel consumption (with weighed quantities of coal and clinker) is carried out and checked against the theoretical volume of CO_2 as calculated, it is found that the theoretical volume of CO_2 must be increased usually by about 4.5% in order to yield results which agree accurately with those found on practical tests.

TABLE SHOWING FUEL CONSUMPTION CORESPONDING TO EXIT GAS ANALYSIS

(1) No. tons* standard coal consumed per 100 tons* clinker made (1 lb. coal gives 12,600 B.t.u.'s) Tons	(2) Theoretical volumeof CO_2 per 100 volumes N_2 in air-free exit gas Volumes	(3) Corrected volume of CO_2 per 100 volumes N_2 in air-free exit gas Factor 1.057 Volumes
Infinite	21.66	22.9
90.01	26.45	27.95
45.77	31.10	32.87
41.00	32.20	34.04
39.23	32.67	34.53
35.30	33.90	35.83
34.31	34.26	36.21
33.00	34.70	36.68
32.00	35.16	37.16
31.00	35.61	37.63
30.46	35.86	37.90
30.12	36.00	38.05
29.77	36.19	38.25
29.45	36.33	38.40
29.14	36.50	38.58
28.82	36.65	38.73
28.51	36.82	38.92
28.21	36.98	39.09
27.92	37.14	39.25
27.63	37.31	39.43
27.35	37.46	39.60
27.08	37.62	39.76
26.80	37.78	39.93
26.02	38.26	40.43
25.04	38.91	41.13
24.80	39.08	41.30
22.66	40.73	43.05
20.85	42.40	44.81
19.30	44.05	46.55
17.96	45.72	48.33
16.77	47.41	50.01
14.79	50.86	53.76
12.52	56.16	59.36
10.15	64.16	67.82
6.36	89.66	94.77

Hence for a given works or plant it is advisable to construct a table as indicated and then check against a single determination of the fuel consumption with weighed quantities so as to ascertain the actual percentage correction to be applied to the theoretical volume of CO_2 as calculated. If, then, a second "practical" table be constructed in which this correction is applied it will be found that the actual fuel consumption can then be read off from this table accurately, minute by minute, with very little calculation or trouble, merely by making accurate analyses of the exit gases by means of an Orsat apparatus.

On one works the dried slurry had the composition of 76.3% $CaCO_3$ and the coal used analyzed: C = 71.6%; H = 5%; S = 1.1%; ash = 17.3%; N = 1.4%. From these data the following table was calculated: *Column* 1 gives the fuel consumption expressed in tons* of standard coal (each pound of which when dried has a calorific value of 12,600 B.t.u.'s per pound) per 100 tons clinker made. *Column* 2 gives the corresponding theoretical volume of CO_2 as calculated. *Column* 3 gives the corrected volume of CO_2, being the results of Column 3 multiplied by the factor 1.057.

Examples of Application

Example 1. The analysis of the exit gases on a certain works was:

CO_2	24.62 vols.
O_2	1.95 vols.
N_2	73.43 vols.
Total	100.00 vols.

What was the fuel consumption of the kiln?

Step 1. Calculate the volume of air present in the exit gas. One volume of free oxygen corresponds to 4.762 vols. of air. Hence 1.95 vols. of oxygen correspond to $1.95 \times 4.762 = 9.3$ vols. of air.

Step 2. Subtract the volume of air from the volume of exit gas. $100 - 9.3 = 90.7$ volumes of air-free gas composed of 24.62 vols. CO_2, and $90.7 - 24.62 = 66.08$ vols. of nitrogen. So that 66.08 vols. of nitrogen con-

*Tons used throughout this series of articles are English tons of 2240 lb.; to convert to American net tons multiply by 1.12.

tain 24.62 vols. of CO_2, or 100 vols. of nitrogen contain $\frac{24.62 \times 100}{66.08} = 37.2$ vols. of CO_2.

Referring to our table, *Column* 3, this shows a fuel consumption of 31.9 tons* of coal per 100 tons* of clinker made.

Found by actual large-scale measurement, 31.4 tons*.

Example 2. The exit gas of another works had the composition:

CO_2	23.34 vols.
O_2	3.38 vols.
N_2	73.20 vols.
Total	100.00 vols.

3.38 vols. of O_2 correspond to $3.38 \times 4.762 = 16.1$ vols. of air. Therefore $100 - 16.1 = 83.90$ vols. of air-free exit gas containing CO_2 equal to 23.34 vols. and N_2 equal to $83.90 - 23.24 = 60.56$ vols.

So that 60.56 vols. N_2 contain 23.34 vols. O_2.

So that 100 vols. N_2 contain 38.55 vols. CO_2.

By the table, 38.55 vols. CO_2 correspond to 29.1 tons* of coal per 100 tons* of clinker. Found by actual large-scale trial, 29 tons*.

METHOD 2. Air consists of 21 vols. of oxygen mixed with 79 vols. of nitrogen. When coal burns, the oxygen is absorbed and nitrogen passes on. Consequently the volume of air-free nitrogen passing out of the kiln measures the amount of oxygen absorbed and so the fuel consumed. This enables us to calculate the fuel consumption knowing the chemical analysis of the fuel, the chemical composition of the cement clinker, and the volume analysis of the exit gas.

The method is best explained by practical examples. By analysis a cement clinker was found to contain 65% of CaO (plus MgO). So that 1 kg. of cement contains 0.65 kg. of CaO (plus MgO).

Now, 56 parts of CaO correspond to 44 parts of CO_2, as is evident from the equation:

$$\underbrace{CaCO_3}_{\underbrace{40+12+48}_{100}} = \underbrace{CaO}_{\underbrace{40+16}_{56}} + \underbrace{CO_2}_{\underbrace{12+32}_{44}}$$

Consequently 1 part of CaO corresponds to 44/56 part of CO_2. So that 0.65 kg. of CaO corresponds to $\frac{0.65 \times 44}{56} = 0.51$ kg. of CO_2. 1 kg. of clinker corresponds to 0.51 kg. of CO_2.

But 1 cu. m. of CO_2 at 0 deg. C. and 760 mm. pressure weighs 1.9632 kg. *So that 1 cu. m. of CO_2 is liberated in the exit gases to every* $1.9632/0.51 = 3.85$ *kg. of clinker produced in the furnace.*

Also from the equation

$$C + O_2 = CO_2$$
$$12 + 32 = 44$$

it will be seen that 44 kg. of CO_2 are produced by the combustion of 12 kg. of pure carbon. That is, 1.9632 kg. of CO_2 are evolved from 0.536 kg. of pure carbon, which is contained in $0.536/0.7115 = 0.753$ kg. of coal.

That is, 1 cu. m. of CO_2 (1.9632 kg.) in the exit gases corresponds to the combustion of 0.753 kg. of coal of the given composition.

Now, if the coal above mentioned were completely burnt in air the composition of the resulting exit gas can be calculated to be: 18.82 vols. of CO_2 and 81.18 vols. of N_2 (total 100 vols.). But from the equation

$$\underset{1\text{ vol.}}{C} + \underset{1\text{ vol.}}{O_2} = \underset{1\text{ vol.}}{CO_2}$$

it will be seen that 1 vol. of CO_2 produced corresponds to 1 vol. of O_2 united with carbon in the coal.

So that to every 81.18 cu. m. of N_2 in the exit gases there must have entered the kiln and united therein with the carbon in the coal some 18.82 cu. m. of O_2. That is, *to every 1 cu. m. of N_2 issuing from the kiln we must have had* $18.82/81.18 = 0.2318$ *cu. m. of O_2 uniting with the carbon of the coal and producing the same volume of CO_2.* With these data we are now in a position to calculate the fuel consumption of the kiln by analysis of the exit gases.

EXAMPLE 1. THEORETICAL COMBUSTION. The exit gas from the rotary kiln had the composition:

CO_2	26.94 vols.
N_2	73.06 vols.
Total	100.00 vols.

Now, as just seen, to 1 cu. m. of nitrogen issuing from the kiln there must have combined with the coal 0.2318 cu. m. of O_2. Therefore, to 73.06 vols. of N_2 issuing from the kiln there must have combined with the coal $73.06 \times 0.2318 = 16.94$ vols. of O_2. And since each volume of O_2 which united with the carbon of the coal produced an equal volume of CO_2,

$$\underset{1\text{ vol.}}{C} + \underset{1\text{ vol.}}{O_2} = \underset{1\text{ vol.}}{CO_2}$$

then obviously 16.94 vols. of CO_2 in the 100 vols. of exit gas must have been derived from the carbon of the coal. But the total volume of CO_2 in 100 vols. of exit gas was 26.94. Therefore $26.94 - 16.94 = 10$ vols. of CO_2, must have come from the dried slurry.

Hence we have:

16.94 cu. m. of CO_2 are derived from the *coal.*
10.00 cu. m. of CO_2 are derived from the *slurry.*

Total 26.94 cu. m. of CO_2.

But 1 cu. m. of CO_2 from the coal corresponds to 0.753 kg. of coal. Therefore 16.94 cu. m. of CO_2 from the coal corresponds to $16.94 \times 0.753 = 12.76$ kg. of coal. And 1 cu. m. of CO_2 from slurry corresponds to 3.85 kg. of clinker. Therefore 10 cu. m. of CO_2 correspond to $10 \times 3.85 = 38.5$ kg. of clinker. So that 38.5 kg. of clinker are produced by the combustion of 12.76 kg. of coal. Or 100 tons* of clinker are produced by the combustion of $\frac{12.76 \times 100}{38.5} = 33.1$ kg. of coal.

EXAMPLE 2. COMBUSTION WITH EXCESS OF AIR. The exit gas from a rotary kiln had the composition:

CO_2	22.81 vols.
O_2	3.29 vols.
N_2	73.90 vols.
Total	100.00 vols.

Air has the volume composition O_2:N_2 equal to 21 : 79. So that 1 vol. of free O_2 is associated with $79/21 = 3.76$ vols. of N_2. The air in the exit gas is a diluent and the composition of the exit gas free from air must be calculated. Since air has the composition above stated, it follows that 3.29 vols. of O_2 are associated with $3.29 \times 3.76 = 12.37$ vols. of N_2. Hence the volume of nitrogen associated with the burning processes in the kiln is $73.90 - 12.37 = 61.53$ vols., the rest of the nitrogen belonging to the free air present.

Now, as just proved, to 1 cu. m. of air-free nitrogen issuing from the kiln there must have been combined with the coal 0.2318 cu. m. of O_2. Hence to 61.53 cu. m. of N_2 issuing from the kiln, there must have combined with the coal $61.53 \times 0.2318 = 14.26$ cu. m. of O_2, which have given rise to the same volume, viz., 14.26 cu. m. of CO_2. So that out of the total 22.81 cu. m. of CO_2, some 14.26 cu. m. are derived from the combustion of the coal and the residual $22.81 - 14.26 = 8.55$ cu. m. of CO_2 are derived from the slurry.

As before, the 8.55 cu. m. of CO_2 from the slurry correspond to $8.55 \times 3.85 = 32.92$ kg. of clinker, and 14.26 cu. m. of CO_2 from the combustion of the coal correspond to $14.26 \times 0.753 = 10.74$ kg. of coal burnt. So that 32.92 kg. of clinker are derived from 10.74 kg. of coal burnt, or 100 kg. of clinker are produced from $\frac{10.74 \times 100}{32.92} = 32.7$ kg. of coal.

EXAMPLE 3. INCOMPLETE COMBUSTION WITH PRODUCTION OF CO. Suppose that the exit gas has the composition:

CO_2	26.6 vols.
CO	0.9 vols.
N_2	72.5 vols.
Total	100.00 vols.

There is no free oxygen present, consequently all the nitrogen present measures the oxygen absorbed by combining with the carbon of the coal. If the combustion of the coal had been complete there would (as before shown) have been 0.2318 cu. m. of O_2 absorbed by the coal for every cubic meter of nitrogen, or the volume of oxygen absorbed under these circumstances from the combustion of the coal is $72.5 \times 0.2318 = 16.81$ vols. of O_2. But the combustion is not complete. There is 0.9 vol. of CO produced which corresponds to 0.45 vol. of O_2 absorbed

$$\underset{1\text{ vol.}}{2C} + \underset{1\text{ vol.}}{O_2} = \underset{2\text{ vols.}}{2CO}$$

So that the oxygen absorbed in the complete combustion is $16.81 - 0.45 = 16.36$ cu. m. of O_2.

Since the CO_2 arising from the complete

combustion of the coal, plus the CO_2 evolved from the slurry equals 26.6 vols., it follows that the volume of CO_2 contributed by the slurry is $26.6 - 16.36 = 10.24$ cu. m. of CO_2, corresponding to $10.24 \times 3.85 = 39.42$ kg. of clinker. And the gases contributed by the coal are: $16.36CO_2 + 0.9CO = 17.26$ cu. m., corresponding to $17.26 \times 0.753 = 13$ kg. of coal (since either 1 cu. m. of CO_2, or of CO, corresponds to 0.753 kg. of coal). So that 39.42 kg. of clinker are produced by combustion of 13 kg. of coal, or 100 kg. of clinker are made from $\frac{13 \times 100}{39.42} = 33$ kg. of coal.

Of course it must be recollected that the figures of the coal thus calculated refer to dry coal of the composition stated.

For commercial purposes the coal can be calculated back in terms of wet raw coal fed to the driers.

The preceding method of calculation appears to have been first suggested by Dr. Albert Heiser (*Tonindustrie Zeitung*, 1913, **37**, Nr. 32, p. 424).

METHOD 3:

Dr. Hans Kuhl (*Zement- und Mörteltechnische Studien*, I, Berlin, 1913, p. 423; *Tonindustrie Zeitung*, 1913, Nr. 32, p. 423) has worked out a general formula for deducing the percentage fuel consumption from the complete analysis of the coal, dried slurry and exit gases:

Let x = the number of parts by weight of dry coal consumed per 100 parts by weight of clinker made.
b = the percentage of carbon in the dried coal.
c = the percentage of hydrogen in the dried coal.
d = the percentage of nitrogen in the dried coal.
e = the percentage of oxygen in the dried coal.
f = the percentage of sulphur in the dried coal.
g = the percentage of ash in the dried coal.
m = the percentage of $CaCO_3$ (plus $MgCO_3$) in the dried slurry.
n = the percentage loss by ignition of the dried slurry.
a = 0.266, the ratio by volume of oxygen to nitrogen in the air (21:79).
p = the volume per cent. of the CO_2 in the exit gases.
q = the volume per cent. of the O_2 in the exit gases.
t = the volume per cent. of the CO in the exit gases.
s = $100 - p - q - t$, is the volume per cent. of N_2 in the exit gas.

Then there are *three constants*, K_1, K_2, K_3, which depend upon the chemical composition of the slurry from which the clinker is made, and upon the chemical composition of the coal used.

These constants may be regarded as constants for a given work using a standard type of coal and a slurry of a definite composition, and may be determined once for all and used in all subsequent calculations.

The *constant* K_1 depends solely upon the *chemical composition of the dried slurry:*

$$K_1 = \frac{400m}{100 - n} \quad (1)$$

where m = per cent. $CaCO_3 + MgCO_3$ in dried slurry.
n = per cent. ignition loss of dried slurry.

There *constant* K_2 depends solely upon the *chemical composition of the coal used in burning:*

$$K_2 = \frac{b}{3} + c + d + a\frac{d}{7} - \frac{e}{8} + \frac{f}{8} \quad (2)$$

where b = % C; c = % H; $a = 0.266$ (vol. % O : N in air); d = % N; e = % O; f = % S.

The *constant* K_3 depends both upon the composition of the coal and the composition of the slurry:

$$K_3 = \frac{b}{3} - \frac{m \cdot g}{2500 - 25n} \quad (3)$$

where b = % C in dried coal; m = % $CaCO_3 + MgCO_3$ in dried slurry; g = % ash in coal; n = % ignition loss of slurry.

There are also *two* variables, V and W, which depend upon the constantly changing composition of the exit gas:

$$V = a\,s - q + \frac{t}{2} \quad (4)$$

where $a = 0.266$ (vol. ratio O : N in air); s = % N by vol. in exit gases; q = % O_2 by vol.; t = % CO by vol.

$$W = p + t \quad (5)$$

p is % CO_2 by vol. t is % CO by vol.

Now it can be proved that knowing these constants K_1, K_2, K_3, and the variables V and W, then we can obtain the percentage fuel consumption x of the kiln as follows:

Step 1. Calculate the value of the constants K_1, K_2, K_3 from the formulas (1), (2) and (3).

Step 2. Calculate the value of the variables V and W from formulas (4) and (5).

Step 3. Substitute these values of K_1, K_2 and K_3, V and W in the formula:

$$x = \frac{K_1 V}{K_2 W - K_3 V}$$

and we obtain the required value x of the number of parts by weight of dried coal (of the composition b % C in dried coal, c % hydrogen, d % nitrogen, e % oxygen, f % sulphur, g % ash), which will produce 100 parts by weight of clinker (of composition m % of $CaCO_3$ [plus $MgCO_3$] in the dried slurry, n = percentage loss by ignition of the dried slurry).

EXAMPLE OF APPLICATION OF KUHL'S FORMULA:

In a particular case the analysis of the raw material and coal used on the works led to the numerical values:

$K_1 = 472.7$; $K_2 = 28.64$; $K_3 = 24.73$

also the analysis of the exit gases led to the values:

$CO_2\% = p =$	27.6	vols.
$O_2\% = q =$	0.2	vols.
$CO\% = t =$	0.2	vols.
$N_2\% = s =$	72.0	vols.
	100.0	vols.

Whence:

$$V = a\,s - q + \frac{t}{2}$$
$$= 0.266 \times 72.6 - 0.2 + 0.1 = 19.2$$
$$W = p + t$$
$$= 27.6 + 0.2 = 27.8$$

Hence the weight of coal used per 10 tons of clinker is:

$$x = \frac{K_1 V}{K_2 W - K_3 V}$$
$$= \frac{472.7 \times 19.2}{28.64 \times 27.8 - 24.73 \times 19.2}$$
$$= \frac{9076}{796 - 475}$$

= 28.3% of dry coal per 100 tons* of clinker made.

For the deduction of Kuhl's formula reference should be made to the original.

The difficulties of applying Kuhl's formula lie in the fact that accurate analyses of the coal and clinker are not always at hand. On the occasions where the writer has applied the formula and checked against direct measurements of the coal and clinker, he has found that the results are too low, sometimes by several per cent. This no doubt is due to the causes enumerated in the first method explained above. No doubt the difficulty could be got over by calibration and then correcting the calculated constants to fit the practical results.

OTHER METHODS:

Formulas have been worked out by Nilsson (*Tonindustrie-Zeitung*, 1905, p. 1877, 1911). Also by Helbig (*Tonindustrie-Zeitung*, 1906, p. 190; 1913, p. 531).

Helbig's work is interesting, as he deduces a connection between the calorific value of the fuel and the clinker output.

(To be continued)

Costa Rican Cement Trade

ABOUT FIVE YEARS AGO the Congress of Costa Rica approved a concession for the installation of a cement manufacturing plant. It was found that the smallest plant had a minimum production capacity too large for local consumption and its cost was too great for the investment.

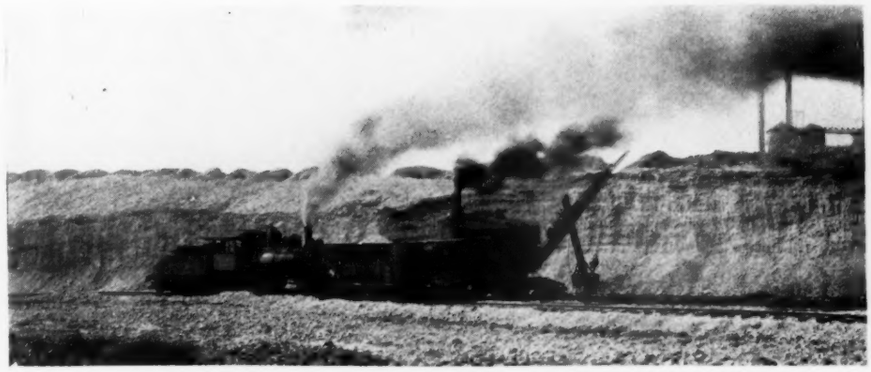
Costa Rica now imports all of its cement which passed the 100,000-bbl. mark in 1928 and for the first six months of this year reached 60,000 bbl. Large road construction projects and relatively increased building construction helped swell the first half year figures, but it is anticipated that the last half of the year may show a decrease.

Floor tiles and ornamental pieces take large quantities of cement in Costa Rica and there is a growing tendency to use cement where stone, brick and lime formerly prevailed. The adobe and lumber styles are giving way to concrete.

About 75% of the total imports are the Alsen brand of European cement, which retails for the equivalent of $4.125 to $4.25 per bbl. and in larger quantities for about 12½ c. a bbl. less.

Birmingham (Ala.) Slag-Aggregate Producers Alive to Opportunities

The Three Principal Slag Producers Are All in the Ready-Mixed Concrete Business—One Makes Cement Products



Loading slag at the pit in the Woodstock plant, Birmingham

THERE ARE three principal producers of crushed and screened slag at Birmingham, Ala., the Birmingham Slag Co., the Sloss-Sheffield Steel and Iron Co., and the Woodstock Slag Corp.

Slag from Birmingham blast furnaces normally moves into six southeastern states for road and bridge building, general construction, railroad ballast and other uses. The three companies operate five plants, having a combined annual producing capacity of approximately 3,000,000 tons.

The largest producer of the three is the Birmingham Slag Co., with one crushing and screening plant at Ensley and a new and more modern crushing and screening plant at the Fairfield works of the Tennessee Coal, Iron and Railroad Co. The Bessemer plant of the Birmingham Slag Co. has been dismantled.

Washed Slag Loaded

The Ensley plant was built about 12 years ago, with most of the equipment supplied by the Allis-Chalmers Manufacturing Co. It uses rotary screens supplemented with Traylor vibrating screens. The plant has a capacity of 3,000 tons of slag per day, all of which can be washed as it is being used. For this purpose, Link-Belt vibrating screens have been installed under the loading gates, which are supplied with water. Segregation is taken care of by allowing the material to "fan" over these vibrating screens and at the same time the gondola being loaded is pulled back and forth under the gate so that alternate thin beds of material are built up in the car. A special 2-drum hoist is used for shuttling the cars, and is so hooked up that the hoist functions automatically.

Partial view of the screening plant of the Sloss-Sheffield Steel and Iron Co., Birmingham. In the background is the ready-mixed concrete plant

The abrasive action of slag is apparent, for the cast, semi-steel liners used for lining the various chutes in the plant last only about six months.

The plant at Fairfield was placed in operation early in 1929 and is designed from experience gained in the field and is said to be the last word in slag-plant crushing and screening practice. The plant is built of steel and slag-concrete brick. Incidentally, the slag-concrete brick used were made at a plant that is owned and operated by the Birmingham Slag Co.

The slag is reclaimed from pits by a Marion No. 125 electric shovel and is carried to the crushing and screening plant in 40-yd., bottom-dump cars. It is then dumped at the crusher house over a Stephens-Adamson, live-roll grizzly, the minus 1½-in. going direct to the elevator, the oversize falling directly into a crusher. After the slag has been crushed it is elevated to the top of the screen house and discharged over a magnetic pulley to Traylor vibrating screens, augmented by live-roll grizzlies.

Proportioned Sizes Loaded

Under the screens are seven bins for storage of the various sizes, each bin having two pockets. A 48-in. conveyor belt is installed under the bins for reclaiming. The bin gates are so constructed that they can be automatically opened and closed by the operator in the loading house. This enables the operator to release on the conveyor belt the exact quantity of each size to make any grading required. The belt is provided with a Merrick "Weightometer." At the discharge end of this belt a horizontal reciprocating cradle has been mounted that is

Slag crushing and screening plant at Woodstock operation

One of the pits at the city plant of the Sloss-Sheffield company

provided with a Hendrick slotted screen and water is sprayed over this screen as the slag is being loaded. Segregation is reduced to a minimum by a similar method to that used at the Ensley plant except that the gondolas are not shuttled under the loading apron.

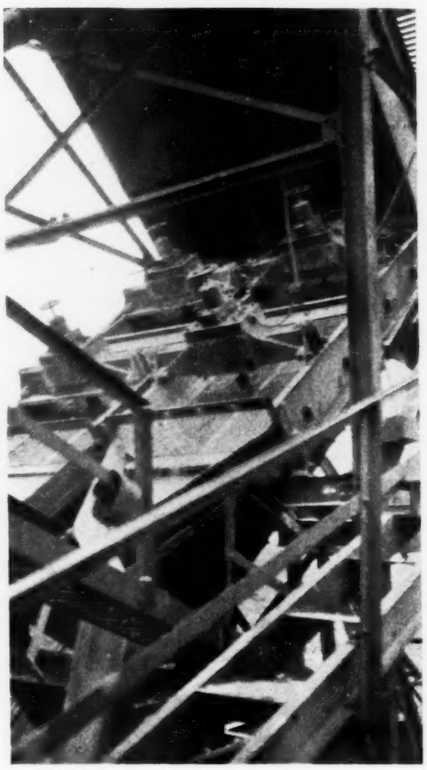
All in Ready-Mixed Concrete Business

One thing that is common to all of the three producers in this area, and one that might indicate the trend of things to other producers of aggregates, is their attitude with reference to ready-mixed concrete. All three producers are ready-mixed concrete manufacturers, the last one to enter the business was the Birmingham Slag Co. with a small plant adjacent to its Ensley operation. Incidentally, too, none of the producers use special types of trucks for transportation of the mixed concrete, but confine themselves to the use of ordinary truck bodies. It was said by one operator that if the slump was kept low enough, there was no segregation of slag concrete.

Ready-Mix Plant Principal Operation of Woodstock

The Woodstock Slag Corp. recently completed a modern ready-mixed concrete plant adjoining its old crushing plant. This company secures its slag from the old Vanderbilt plant of the Woodward Iron and Steel Co., a short distance from the crushing plant. The steel plant is now inactive, but about two years' supply of slag still remains at the plant. It is expected that before that time elapses the steel company will resume operations.

The slag is loaded by a No. 25 Marion steam shovel, having a 1-yd. dipper, to standard-gage gondolas, that are hauled to a hopper at the crushing plant. A No. 7½ Telsmith crusher is used. The crushed slag is sized on a series of vibrating screens and falls to bins below, from which the material can be drawn to a cross belt conveyor to the main 18-in. Jeffrey belt conveyor serving the new ready-mixed plant. Sand for the fine aggregate is secured from pits near Montgomery, Ala., and is delivered to separate steel bins at the mixing plant by the same 18-in belt.



Four of the Sloss-Sheffield plant's vibrating screens

The Woodstock company's ready-mixed concrete plant

The bins were made by the Eagle Iron Works and discharge to Blaw-Knox batchers that serve the two 2-yd. Smith mixers. The belt conveyor is driven by a 25-hp. Westinghouse motor through a James gear reduction unit. Bagged cement is unloaded to a warehouse from which the sacks can be elevated to the mixing floor by a special barrel type elevator, that lifts the filled sack to the floor above. Bulk cement handling equipment was being considered at the time of the writer's visit. A. W. Smith is in charge of the concrete department of the Woodstock Slag Corp.

Pioneer Ready-Mix Slag-Concrete Plant

The Sloss-Sheffield Steel and Iron Co. was one of the pioneers of ready-mixed, slag concrete and secures its slag from blast furnaces within a short distance of the heart of the city of Birmingham. In its crushing plant a 7-ft. Symons cone crusher and both rotary and vibrating screens are used. The rotary screening plant is old but more re-

cently an addition was made to the screening equipment, using a series of 12 "Hummer" screens for the classifying. The products from both the rotary screen and the vibrating screens fall to steel bins, from which the material can be drawn to trucks through Blaw-Knox batchers, or to a belt conveyor serving the ready-mixed concrete plant. At this plant as well as at all the slag plants in the district, magnetic pulleys are used on belt conveyors at advatageous points to protect subsequent crushing equipment.

The plant has a capacity of 2000 tons of crushed slag per day.

A Marion Type 37 electric shovel mounted on crawler treads is used for loading from any of the four pits that the company uses at the city plant. The shovel has a 1½-yd. bucket and loads to standard-gage gondolas for delivery to the track hopper serving the feeder belt to the cone crusher that acts as a primary breaker.

L. H. Moehr is in charge of the slag department of the Sloss-Sheffield Steel and Iron Co.

Rock Products Chemistry

IN numerous articles such as those by Mr. Azbe and Mr. Duchez on lime and cement manufacture appearing in ROCK PRODUCTS frequent use is made of chemical symbols, formulæ and equations. Naturally anyone not familiar with the meaning of these will not derive the full benefit from these offerings. In order to present such articles more and comprehensively this brief presentation of such chemical knowledge is being given. We hope it may prove beneficial, and, as we do not know exactly how much chemistry is known to men in the industry.

Matter in its elementary forms is theoretically of very small particles, atoms. The term "element" is given to each different kind of atom. Thus each atom that has certain characteristics, such as size, weight and behavior, is designated by that name which has been assigned to that form of matter. These names have been abbreviated into what are known as symbols for the elements. The elements that are most common in the industry and their symbols are:

ELEMENT	SYMBOL
Calcium	*Ca*
Magnesium	*Mg*
Carbon	*C*
Oxygen	*O*
Sulphur	*S*
Iron	*Fe*
Aluminum	*Al*
Hydrogen	*H*
Silicon	*Si*

Atoms of the same and different elements unite with each other to form unit quantities of compound substances called molecules. These molecules are represented by formulæ which show which kind of atoms and the relative number of each present in a given compound, as: $CaCO_3$ represents one molecule of calcium carbonate (pure limestone) in which are combined one atom of calcium, one atom of carbon and three atoms of oxygen. A few of the substances in the rock products industry with their chemical names and formulæ are:

COMMON NAME	CHEMICAL NAME	FORMULA
Limestone (calcite)	*Calcium carbonate*	$CaCO_3$
Lime	*Calcium oxide*	CaO
Hydrated lime	*Calcium hydroxide*	$Ca(OH)_2$
Silica	*Silicon dioxide*	SiO_2
Magnesia	*Magnesium oxide*	MgO
Alumina	*Aluminum oxide*	Al_2O_3
Gypsum	*Hydrous calcium sulphate*	$CaSO_4.2H_2O$
Plaster of Paris	*Hemihydrate of calcium sulphate*	$CaSO_4.1/2H_2O$
Dead burned plaster	*Anhydrous calcium sulphate*	$CaSO_4$
Fluorspar	*Calcium fluoride*	CaF_2
Magnesite	*Magnesium carbonate*	$MgCO_3$
Water	*Water*	H_2O
Dolomite	*Calcium-magnesium carbonate*	$CaCO_3.MgCO_3$

Wire Saw Effects Savings

THE WIRE SAW introduced to the slate industry of the country by the United States Bureau of Mines has proved a pronounced success. In 1929, the third year of its operation in this country, the estimated annual saving to the Pennsylvania industry was at least a quarter of a million dollars. As the total value of slate production in Pennsylvania amounts to less than $6,000,000 annually, the figure is significant. The wire-saw method of separating masses of slate from their original beds is credited with having revolutionized slate quarrying in Pennsylvania and re-established the industry on a more secure basis.

Wire rope as hoist cable or guy wire to support masts and derricks is familiar equipment in mines and quarries, but wire has not been used much as a tool for cutting rock in this country until recently, says Dr. Oliver Bowles in Technical Paper 469, just published by the Bureau of Mines. The wire saw is essentially a 3-strand wire cable running as an endless belt. The cable is the saw blade, and the teeth of the saw are sand grains carried in the spiral grooves formed by the winding of the wire strands. The wire belt is carried by orienting pulleys from the driving unit to the place in the quarry where a cut is desired. Where the wire comes in contact with the rock, sand fed to it with a small stream of water is caught in the grooves of the cable and carried along. The sand grains thus forced against the rock and dragged along with the cable wear away the rock rapidly and make a cut a little wider than the wire.

Everyone who visits the slate districts is impressed by the magnitude of the accumulated mountains of waste. Investigators estimate that 70 to 95% of the gross production has been thrown away. Various operators estimate a saving of 30 to 50% of this waste due to the use of the wire saw.

The success of the wire saw in slate quarries suggests extending its use to slate-finishing mills. In mills in which circular saws are now employed many blocks might be lined up so that they could all be cut at once with a wire. Such a process is not new. The wire saw has been used for many years at marble yards. Ten to twenty blocks are lined up, and a wire is used to "scabble" or square them up by slabbing off the irregular surfaces.

Engineers of the Bureau of Mines are convinced that in developing the wire saw a step has been made in quarry efficiency that means economy in manufacture and that will be reflected increasingly to the advantage of multitudes of those who dwell under slate roofs or in structures made of stone. There is no apparent reason why the wire saw will not cut other rocks. Already its use is extending to the marble, limestone, and soapstone industries and to other slate-producing districts. The use of a core drill in granite is about to be tried. Apparently, the dimension-stone quarrying industries are on the threshold of radical changes in methods, in which the principle of cutting by abrasion will be utilized to an increasing extent.

Further details are given in Bureau of Mines Technical Paper 469, "The Wire Saw in Slate Quarrying," which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at a price of 15 cents.

Booklet on Swimming Pools

THE DEMAND for information has prompted the Portland Cement Association to publish "Swimming Pools," a profusely illustrated 32-page booklet. The illustrations and text show that it is a comparatively simple matter to construct attractive and serviceable pools both indoors and outdoors. Various designs for pool construction are pictured and those interested in construction features will find the specifications for concrete particularly helpful.

Factors influencing the selection of site, determination of size and shape, as well as the general arrangement of pool facilities, are given detailed attention. Text devoted to ways of controlling condensation and a brief discussion of the acoustical treatment of the walls and ceilings of indoor pools add further to the booklet's practical value. Underwater and overhead lighting, pool sanitation and the different methods of filtration and sterilization are outlined.

Copies of "Swimming Pools" may be obtained without cost from the association offices at 33 West Grand avenue, Chicago.

Gypsum and Gypsum Products Manufacture—Part II

Raw Gypsum, Composition, Properties, Impurities, Decomposition; Calcined Gypsum; Processes; Control; Products

By S. G. McAnally

Chief Chemist, Giant Portland Cement Co., Egypt, Penn.; formerly Chemist for the Pacific Portland Cement Co., Mound House, Nev., and Chemist and Superintendent for the Standard Gypsum Co., Ludwig, Nev.

AN INQUIRY into the chemical and physical changes and the general properties of gypsum calcined at various temperatures is interesting. In Fig. 4 is shown the temperature curve of a calcination to 370 deg. F., and the results of various tests are tabulated in Table V. The "loss curve," Fig. 4, shows that the gypsum loses water steadily until the temperature reaches 325 deg. Between 325 and 340 deg. there is no additional loss and the composition is uniform for several minutes. This is during the first settle period (see Fig. 2, Rock Products, July 5, p. 71). From 355 to 370 deg. the calcined gypsum loses water rapidly. The percentage loss is not uniform during the calcination. Referring to the "Loss" column (Table V), it will be noted that the loss between 1:40 p.m. and 2:20 p.m. is greater than that between 3 p.m. and 3:40 p.m. The percentage loss during the loading period cannot be included in the comparison; there are other factors to be considered, but previous experiments on low temperature decomposition (see Fig. 1, Rock Products, July 5, 1930, p. 71), indicate that dehydration is most rapid during the first cycle, $CaSO_4 \cdot 2H_2O$ to $CaSO_4 \cdot 1\frac{1}{2}H_2O$. Although not shown in Table V, the percentage loss during the second boil is much greater than during the preceding period.

The theoretical composition of possible compounds or hydrates of calcium sulphate is given in the sixth column. In the seventh column is the weight per cubic foot (pressed) for the particular samples. The raw fineness was 40% passing 200-mesh. The "density curve," Fig. 4, is plotted from the weight per cubic foot values in column seven. These values were obtained by compressing and weighing unit volumes of the raw gypsum and of the samples of the material taken at different periods during calcination to 370 deg. It will be noted that the density increases rapidly after the first half hour and reaches a maximum about 20 minutes later. Thereafter there is a more or less gradual decrease in the density of the material with continued calcination and increasing temperatures up to 370 deg. Tests on plaster calcined for a comparatively longer period, and to higher temperatures than that shown in Fig. 4, show that there is an increase in density during the second boil and second settle, a decrease at 373 deg. when the material begins to swell and an increase in the density at the third settle.

The reciprocals of the densities would give the comparative pressed volumes of the different materials. A volume curve, based on the pressed volume values, would not agree with the "settling" curve in Fig. 2, (Rock Products, July 5, p. 71); some similarity would be looked for. However, it must be remembered that the weight of the material (calcined gypsum) in the kettle is continually decreasing due to the loss of the combined water. The ratio of the amount of plaster in the kettle at any period to the density of the plaster at the same period will, for convenience, be called the "absolute volume." The "absolute volume" curve, in Fig. 4, shows the relative volume of the material in the kettle at the different stages of dehydration, but not under kettle conditions; i.e., boiling, settling, etc. During the period of intense boiling the curve will rise; it would drop when the boiling ceases and the settles occur. The "absolute volume" curve in Fig. 4 and the "settling" curve in Fig. 2 are somewhat similar during the first boil period. Evidently the gradual settling of the material during the first "boil" is due to (1) loss by dehydration, (2) changes in the density of the calcined gypsum; the action of the first is positive; the second action is negative.

When gypsum is calcined to the hemihydrate there is an increase in the specific gravity but a decrease in the weight per cubic foot. The latter is caused by a change in the texture of the calcined material; the particles swell when they reach a certain stage of decomposition. The discrepancy between the "absolute volume" and the "setling" curves at temperatures above 300 deg. F. may be due to the change in texture; the material feels softer and less gritty; it is "sticky" or more adhesive.

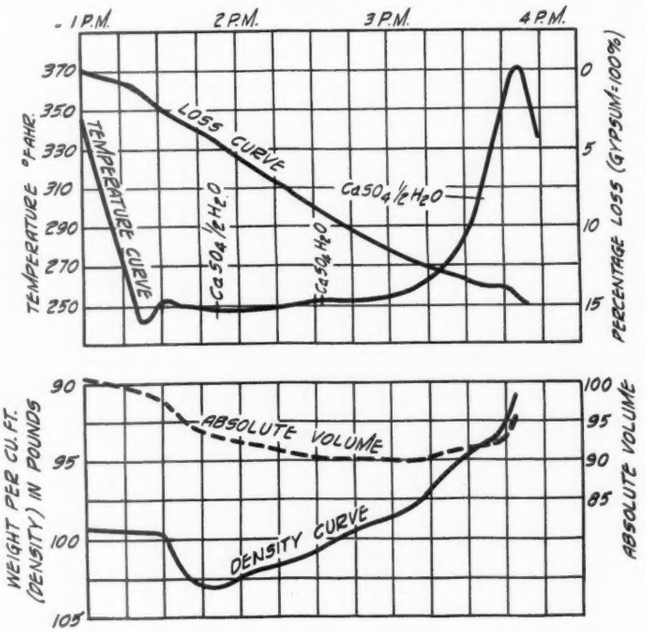


Fig. 4. Temperature curve of a calcination to 370 deg. F.

Point of Maximum Density —Why?

Referring to Fig. 4, it will be noted that the material reaches reaches its maximum density at a point corresponding to $CaSO_4 \cdot 1\frac{1}{2}H_2O$. Why is this? Although the maximum density was obtained on an average of two samples, yet it is safe to say that at a temperature corresponding to the above "compound" the density is greatest. It is also interesting to note that the density does not fall below that of the raw gypsum until the $CaSO_4 \cdot H_2O$ stage is passed. Even the change to the hemihydrate is followed by an irregularity in the curve (sudden rise).

In Table V the consistency figures are approximately corect; the aim was to produce plastic mixes of equal consis-

tency, but the tests were made chiefly for setting time. (Later in this series the effects of calcining temperatures on consistency, etc., will be discussed.) As the composition approaches the hemihydrate there is a decided lengthening of the set and the change to the hemihydrate is very marked in the setting time.

Nature of Calcined Gypsum

Le Chatelier, in his experiments, heated a saturated solution of gypsum in a closed tube to a temperature between 265 and 300 deg. F. and obtained long rectangular crystals which he was able to separate. These crystals contained 93.3% $CaSO_4$ and 6.7% H_2O. Loss of H_2O equaled 72.8% (compare with Tables I to IV in Rock Products, July 5, 1930, pp. 70-71). His experiment is almost sufficient evidence to prove the existence of the hemihydrate, which, when pure, contains 93.8% $CaSO_4$ and 6.2% H_2O. I once heard the statement that plaster of Paris was merely a mixture of completely dehydrated gypsum ($CaSO_4$) and raw gypsum ($CaSO_4 \cdot 2H_2O$). On this assumption a mixture of raw gypsum and partially calcined gypsum would have the same physical properties as the product calcined to contain the same percentage of combined water as the mixture.

boil" stucco there is a period, during calcination, at which a large amount of heat is absorbed (endothermic); and in the manufacture of "double boil" plaster there are two such periods. If water is mixed with a cold, but fresh, sample of "double boil" material, the mixture heats considerably at once. In about 15 or 20 minutes the mass will set. A few minutes after setting, the material heats again; the second heat is not so intense as the first, but it is of longer duration. Eventually the set plaster becomes similar in composition to raw gypsum. The analogy between dehydration and hydration may be expressed by equations:

First stage dehydration	1.	$2(CaSO_4 \cdot 2H_2O)$ + low heat (305 F.) = $2(CaSO_4 \cdot \frac{1}{2}H_2O) + 3H_2O$ (water)
		(gypsum) (hemihydrate)
Hydration	2.	Hemihydrate + water = gypsum + low heat
Second stage dehydration	3.	$2(CaSO_4 \cdot \frac{1}{2}H_2O)$ + high heat (370+ F.) = $2CaSO_4 + H_2O$ (water)
		(hemihydrate) (soluble anhydrite)
First stage hydration	4.	Soluble anhydrite + water = hemihydrate + high heat
Second stage hydration	2.	Hemihydrate + water = gypsum + low heat

Fig. 6 shows the heating of "double boil" plaster when it is mixed with water.

The interpretation is, that when the water and plaster are mixed the first heating is that part of the chemical reaction (exothermic), due to the change from soluble anhydrite to hemihydrate; the second heating (after the pat has set) is due to the formation of a higher hydrate or of raw gypsum. The reactions are the reverse of those occurring during dehydration.

The time-temperature curve of the calcination of gypsum to 375 deg. plus, by the kettle process, is composed of two horizontal lines approximately 120 deg. apart, and two arcs. One arc joins the two horizontal lines, and the other is a prolongation of the top line. Complete dehydration occurs in at least two stages; in the first stage (assuming there are only two), the compound, $CaSO_4 \cdot \frac{1}{2}H_2O$, is formed; in the second, $CaSO_4$ is produced. Under manufacturing conditions, the hemihydrate is produced at approximately 300 deg. F.; and complete dehydration occurs between 450 and 500 deg. F.

It has been stated, by one authority, that partially dehydrated gypsum (before completion of calcination to plaster of Paris) is a mixture of raw gypsum and hemihydrate. If this were true, one would expect to duplicate a product intermediate between the raw gypsum and the hemihydrate by mixing the proper proportions of raw and of the hemihydrate. Referring to Table V, it would require 6.15 parts of raw and 6.74 parts of the hemihydrate (5.25% H_2O) to produce an intermediate product similar in composition to sample No. 8, which contains 11.40% water. Based on the consistency (water used for mixing), the mixture would require 46.2% water for mixing, whereas sample No. 8 required 39.3%. Experience with mixtures containing such a large proportion of raw has shown that these mixtures will not set hard. Further, the weight per cubic foot of the mixture would be 96.7 lb.; No. 8 weighs over 100 lb. per cu. ft.

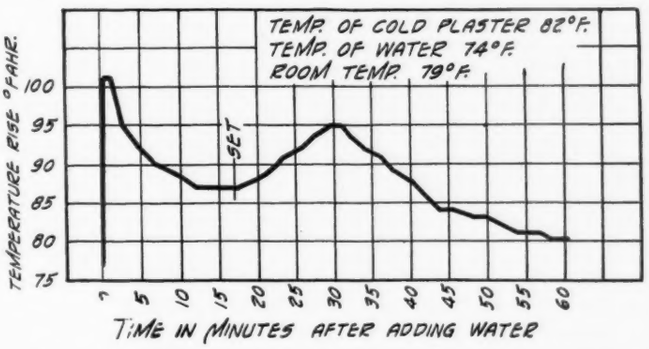


Fig. 5. Curve of a calcination to 375 deg. F. and higher

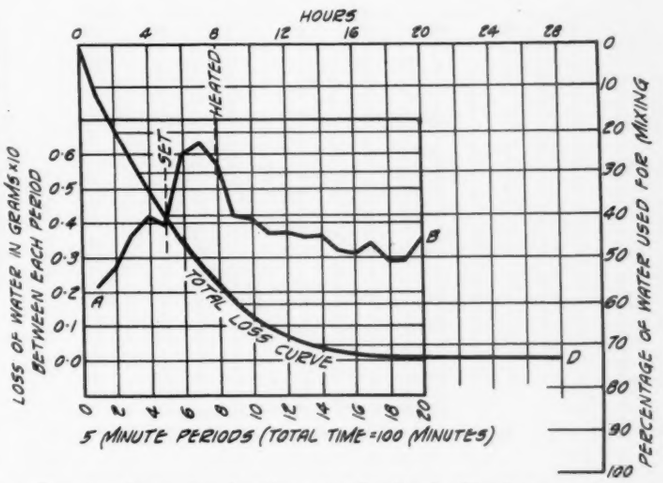


Fig. 6. Shows the heating of "double boil" plaster when mixed with water

To test the statement, I mixed proportions of samples No. 1 and No. 17 (Table V) to duplicate the composition of sample No. 15. Following are the results:

Mixture Nos.	Water for consistency	Setting time	Heating
1 and 17	61.0%	4 min.	2 min.
No. 15	61.3%	11½ min.	6½ min.

Two Periods of Calcination—Two Periods of Hydration

In studying the time-temperature curve of the calcination of gypsum to 375 deg. and higher, attention was directed to its shape. The two horizontal lines represent periods in which the endothermic (heat absorbed) reactions are more pronounced. The first occurs before the hemihydrate is formed, and both occur when gypsum is calcined to complete, or nearly complete, dehydration. The latter product is known as "second settle," "double boil," soluble anhydrite and other names. The point to be noted is, that at one stage of the manufacture of "single

The maximum density of the calcined material at the period corresponding to $CaSO_4 \cdot 1\frac{1}{2}H_2O$ has already been noted. There may be five definite compounds of calcium sulphate; $CaSO_4 \cdot 2H_2O$, $CaSO_4 \cdot 1\frac{1}{2}H_2O$, $CaSO_4 \cdot H_2O$, $CaSO_4 \cdot \frac{1}{2}H_2O$ and $CaSO_4$. The latter has two or more forms.

Effect of Raw Gypsum in Stucco

It has been stated by some that plaster of Paris (single boil stucco) calcined by the kettle process to a temperature of from 340

TABLE V—TESTS ON RAW AND CALCINED GYPSUM

Sample No.	Time	Temp.	% Loss	% H_2O	Composition	Lb. per cu. ft.	Consistency or water for mixing	Setting time	Heating of pat after setting	Remarks
1	1:00 P. M.	Raw	0.00	18.14		99.4				Started to load.
2	1:25	245 F.	1.66	16.76			33.3%	no set	no heating	Kettle loaded.
3	1:30	252	2.31	16.20		99.6	33.3	no set	no heating	
4	1:40	250	3.47	15.20		102.8*	33.3	no set	no heating	
5	1:50	248	4.21	14.55	$CaSO_4.1\frac{1}{2}H_2O$		33.3	2 min.	at once	pat soft
6	2:00	248	5.43	13.44	$= 14.25\%\ H_2O$		34.7	2 min.	in 1½ min.	pat soft
7	2:10	248	6.40	12.54		101.8	37.3	3 min.	in 1½ min.	pat fair
8	2:20	250	7.61	11.40			39.3	3 min.	in 1½ min.	pat hard
9	2:30	252	8.73	10.31	$CaSO_4.H_2O$	100.7	42.0	3 min.	in 2 min.	pat hard
10	2:40	252	9.68	9.37	$= 9.98\%\ H_2O$		44.4	3½ min.	in 2 min.	pat hard
11	2:50	255	10.40	8.59		99.1	45.3	4½ min.	in 2 min.	pat hard
12	3:00	255	11.31	7.71			52.0	4 min.	in 1½ min.	pat hard
13	3:10	260	12.10	6.87		97.8	57.3	4½ min.	in 2 min.	pat hard
14	3:20	268	12.72	6.21			60.0	5½ min.	in 2½ min.	pat hard
15	3:30	285	13.26	5.63	$CaSO_4.\frac{1}{2}H_2O$	94.7	61.3	11½ min.	in 6½ min.	pat hard
16	3:40	325	13.74	5.10	$= 5.25\%\ H_2O$		61.3	16½ min.	in 5½ min.	pat hard
17	3:43	340	13.67	5.18		93.3	61.3	17½ min.	in 5½ min.	pat hard
18	3:46	355	13.98	4.84			61.3	17 min.	in 7 min.	pat hard
19	3:50	370	14.58	4.17		89.0	64.0	16½ min.	in 5½ min.	pat hard
20	3:55	370	14.91	3.80			64.6	19½ min.	in 6 min.	pat hard Sp.Gr.—2.44

*Average of 4th and 5th samples. Raw fineness—40% passing 200 mesh. Sp.Gr. of Raw—2.35

to 350 deg. F. contains more or less raw gypsum. Raw gypsum, if not too coarse, explodes at the above temperature. This is referred to in the phenomenon of "boiling-over." Raw gypsum will not exist on the surface of the calcined particles. If it is present in the stucco, it will be in the cores. When water is mixed with plaster, the particles slake, as it were, forming an emulsion and leave the cores exposed. If these cores are raw gypsum, they will not be dissolved, due to the much greater solubility of the hemihydrate at normal temperatures.* The undissolved cores would cause quick setting of the plaster.

When the temperature of the plaster being calcined reaches 320 deg. (past the hemihydrate stage), the period of maximum setting time has been reached; there are exceptions. If raw gypsum were present at the above temperature, calcination to higher temperatures should partially or entirely calcine it, and slow the setting time. However, as a rule, higher calcination does not slow the set. Assuming that the cores were still unattached at the higher temperature, regrinding of the calcined material would increase the number of raw particles and cause quicker sets. (The efficiency of raw gypsum as an accelerator depends on its fineness.) But regrinding does not cause quicker sets.

When gypsum is calcined to 290 deg. F. the plaster contains more combined water than the theoretical amount, and it is quicker setting than that calcined to between 310 and 360 deg. If the 290-deg. material is held in the hot-pit for one hour, the setting time will be normal, but if the 340-deg. material is held in the hot-pit for one hour, it will become quicker setting; if raw cores were present, the material should become slower setting. What really happens when the 290-deg. material is left in the hot-pit is that the particles (not cores) of raw gypsum, or of hydrate higher than the hemihydrate are calcined to the latter product. Finely divided particles of raw gypsum do not exist as such at the usual calcining temperature for plaster of Paris.

*Partridge and White—*Jour. Am. Chem. Soc.*, Vol. 51; "Solubility of Raw Gypsum and Hemihydrate."

Analyses of the portions of single boil stucco retained on the 50-mesh, on the 100-mesh and passing the 100-mesh, of samples from different sources, gave conflicting results. The assumption was, that if raw gypsum were present in the cores, the coarsest portion would contain the highest percentage of combined water. Results of two such tests follow.

TEST No. 1

Material	% Combined water
Stucco "as is"	4.85
Retained on 50-mesh	5.90
Retained on 100-mesh	5.50
Passing 100-mesh	5.40

TEST No. 2

Material	% Combined water
Stucco "as is"	5.50
Retained on 50-mesh	5.82
Retained on 100-mesh	5.90
Passing 100-mesh	6.05

Screen analysis.
Retained on 50-mesh....10.0%
Retained on 100-mesh....24.0%

The portions are all higher in combined water than the original sample; this is due to the aging (absorption of atmospheric moisture) of the portions.

Raw gypsum quickens the set of plaster. In a third test, the portions passing and retained on an 80-mesh screen were tested for setting time and the following results were obtained:

Material	Setting time	Mixing water used
Plaster "as is"	13 min.	84%
Retained on 80-mesh	15 min.	84%
Passing 80-mesh	12 min.	85%

There is no evidence that plaster of Paris, as it leaves the kettle, contains raw gypsum. Higher temperatures, instead of slowing, quicken the set. Calcined gypsum, as a rule, reaches its maximum set about 320 deg. and begins to quicken after it reaches 370 deg.

"Double boil" or "second settle" plaster is a mixture of hemihydrate ($CaSO_4 \cdot \frac{1}{2}H_2O$) and completely dehydrated gypsum ($CaSO_4$). It has a quicker setting time than "single boil" plaster. When $CaSO_4$ is first formed in the kettle it is very quick setting and has a specific gravity of about 2.60. Between 500 and 600 deg. F., the kettle product sets in about two or three minutes. Continued heating changes the characteristics and produces a slow setting and denser product having a specific gravity of about 2.80. This material is used for making Keene's cement. Very high temperatures convert the gypsum into a very inert material very similar to native anhydrite which has a specific gravity of 2.88.

Plaster Setting Phenomena

When water is mixed with plaster of Paris, so as to form a thick cream, the mass first begins to thicken and then sets fairly hard. The setting time of different plasters will vary from 15 to 40 min. A short time after the set has occurred the material heats more or less, then cools again. Meanwhile the set plaster gets harder, then it softens a little, gets hard again and eventually attains a tensile strength of from 400 to 500 lb. per sq. in., or twice as strong as the tensile strength of the solid gypsum from which the plaster was made. The softening period and the degree of softening vary with different plasters, and depend on the length of setting time, on the amount of mixing water used and on the normal consistency of the plaster. With some plasters, softening may occur within one hour after the mass has set; with others, it may not happen for several hours. The time required to attain maximum strength also varies, but, as a rule, is about three days, depending, of course, on the size and thickness of the casting.

It would be natural to assume that the maximum rate of evaporation of the water from the wet mixture would be while the mass is still wet and plastic; i.e., before it has set. However, this is not the case. A test was made to determine the rate of evaporation of the water from a small pat made by mixing "single-boil" stucco with enough water to form a thick cream. A portion of the wet mixture, about 12 grams, was quickly weighed in a tared watch glass on an analytical balance. The weighings were repeated every 5 min. (without removing the watch glass and its contents from the balance) during 100 min., and at longer periods thereafter until the weight was constant. The major portion of the wet mix was used to determine setting time and period of maxium heating. The results are tabulated in Table VI.

TABLE VI — EVAPORATION LOSS OF PLASTER OF PARIS DURING HARDENING PERIOD

Time in minutes after mixing	Weight in grams of wet plaster	Loss in grams between each weighing	
0	11.3540		
5	11.3320	0.0220	
10	11.3045	0.0275	
15	11.2680	0.0365	
20	11.2260	0.0420	
25	11.1870	0.0390	Set
30	11.1270	0.0600	
35	11.0640	0.0630	
40	11.0070	0.0570	Heated
45	10.9650	0.0420	
50	10.9240	0.0410	
55	10.8870	0.0370	
60	10.8500	0.0370	
65	10.8140	0.0360	
70	10.7780	0.0360	
75	10.7460	0.0320	
80	10.7150	0.0310	
85	10.6810	0.0340	
90	10.6520	0.0290	
95	10.6230	0.0290	
100	10.5870	0.0360	

In Fig. 6, the irregular line *AB* is plotted from the values corresponding to the loss of water between each consecutive weighing at the 5-min. periods. The material had a setting time of 25 min. and developed maximum heat 15 min. later It will be noted that during the 20 periods (1 hr. 40 min.) the minimum loss was at the first two periods, when the plaster was "wettest." At the fourth period a peak is reached, but the action of the set caused a decrease in the loss. When the material set the loss increased considerably, and the maximum loss in unit time occurred in the seventh period. The maximum heating of the set plaster occurred later; and contrary to expectations the rate of evaporation decreased rapidly, at first, but gradually between the ninth and the 16th periods. There are two more peaks, indicating periods of increased loss. Subsequent weighings, but at longer intervals, showed that the loss decreased gradually thereafter.

In Fig. 6, the curve *CD* shows the total loss of water from the time materials were mixed until the set plaster attained constant weight.

The probability of the existence of compounds intermediate between raw gypsum and hemihydrate has been mentioned in this series, and in order to explain the setting, heating, softening and ultimate hardness of the plaster, the direct change from hemihydrate to raw gypsum is hardly sufficient. The above actions cannot be properly explained until it has been definitely established whether or not there are intermediate products formed during calcination. Several theories have been advanced to explain the setting and hardening of plaster of Paris. They are all interesting even if not accepted as satisfactory.

Analogies of Reversal Cycle

Reference was made to the analogy between the dehydration of gypsum and the hydration of the hemihydrate (plaster of Paris). Hydration may be expected to follow the reversal of the cycle of dehydration. The main occurrences in the reversal of hemihydrate would be: Swelling (reversal of settling), maximum hydration and liberation of heat (exothermic), sudden expansion (lower density) and minimum hydration. Solution of the hemihydrate and later precipitation of less soluble hydrates is an essential. Hemihydrate does not easily change to raw gypsum. Samples of the former which have been moistened so as to contain from 8½ to 10½% water, on being exposed to the atmosphere, have lost from 1½ to 2½% of their weight. Plaster of Paris exposed for several years in cloth sacks will not change to raw gypsum. Exposure over water for several weeks will change the plaster to gypsum, but the material hydrated in this manner will not become hard. An excess of water is essential to cause the latter action.

Following the reversal of the cycle of hydration, the first action, after a saturated solution of the hemihydrate had been formed, would be for the plaster to swell, causing the wet mixture to thicken and take on the appearance of a dry mixture. Soon the set occurs, and, as indicated by the drop in the loss curve *AB*, Fig. 6, water is absorbed to form a higher hydrate. Following the set, the rate of evaporation is very rapid, indicating a short period of inactivity. Then the plaster heats and maximum hydration occurs. Due to the lower solubility of hemihydrate at higher temperatures, a supersaturated solution will be formed when the plaster heats, and a higher hydrate, probably gypsum, will be precipitated. This hastens the hydration in the same manner as would the addition of raw gypsum to the dry plaster. As the temperature of the mass decreases, more lower hydrate goes into solution, more gypsum is precipitated due to the presence of the raw nucleii, and solution and precipitation proceed simultaneously until hydration is completed.

The strength of set plaster, especially if the dry plaster has been aged, at the end of two hours is almost equal to that at 24 hours. It is feasible to assume that hydration to gypsum is completed within from two to four hours. Thereafter, any increase in strength is due to evaporation of the excess water.

(To be continued)

Canada's Phosphate Deposits

CANADA POSSESSES deposits of crystalline phosphate of lime, or apatite, that are probably the most extensive known, Norway being the only other country believed to possess important resources of this mineral. Analyses of clean, lump Canadian apatite show it to carry about 85% of tricalcic phosphate. It is a fluor-apatite as contrasted with the Norwegian mineral which is chlor-apatite, and it contains about 3% of fluorine.

The Canadian phosphate bodies are found in two main districts, one in Quebec and the other in Ontario, and both near Ottawa. The deposits formerly were systematically mined and have yielded a total recorded output of over 300,000 tons, most of which was utilized in the manufacture of superphosphate, but these operations virtually came to an end about 1895 with the discovery, in other parts of the world, of enormous bodies of sedimentary phosphate which could be mined much more cheaply. Almost all of the small tonnage of apatite produced in Canada during the past twenty years has been obtained as a byproduct of mica-mining operations, and most of it has been utilized locally in the manufacture of phosphorus and fertilizers.

Although Canadian apatite cannot offer any commercial possibilities at the present time as a raw material for the fertilizer industry, which consumes the bulk of the world's phosphate output, it is of interest to note that during the past year the Mines Branch has received an unusual number of requests for information relating to the deposits and the practicability of obtaining a supply of Canadian apatite.

Little indication has been given by correspondents as to the purpose for which the mineral might be required.

This renewed interest in Canadian phosphate occurrences suggests the possibility that crystalline apatite may prove superior to rock phosphate for certain purposes, and that if this superiority be decided enough to warrant the higher price being paid, a revival of the Canadian apatite mining industry may follow.

Beds of sedimentary phosphate rock in the Crowsnest Pass district of the Rocky Mountains, just west of the Alberta-British Columbia boundary, have recently been investigated by the Consolidated Mining and Smelting Co. These deposits consist of phosphatic shales and limestones and are favorably situated in respect to rail transportation. The run-of-mine rock is reported to average around 50% tricalcic phosphate, and the main bed to range in thickness from 3 to 12 ft. A small tonnage of the phosphate has been mined and shipped to the company's works at Trail, B. C., for experimental purposes in the manufacture of triple superphosphate, and the results are reported as so satisfactory that a large unit is being erected for the manufacture of this product.

Brazilian Cement Business

UNITED STATES continues to obtain only an insignificant quantity of Brazil's cement trade, according to information from Vice Consul R. E. Cohn, Rio de Janeiro. Most of the business goes to Belgium, Denmark and Great Britain. Brazil produced 3,137,253 bbl. valued at $7,391,146 in 1929 and imported 2,673,859 bbl. at $6,835,531. America shipped 23,402 bbl. of hydraulic cement valued at $124,579.

Promotion of Premium Aggregates

Profit Will Come to the Cement and Aggregate Industries by Making, Knowing and Capitalizing the Quality and Virtues of Industrial Products Rather Than Through Attempts at Standardizing Them

By Stanley M. Hands, C.E.
Junior Testing Engineer, Division of Highways, State of California

NOW that some of the important fundamentals of concrete mixtures have been firmly established, research is concentrating on the reason for variations in the results of tests. The answer seems to be that the full effect of fractions of a mix cannot be predetermined. Though the fraction can be analyzed, the only satisfactory and practicable way to know what the results will be is to actually make up the concrete and test the specimens for desirable quality. After the tests show that the quality is good, the whole is analyzed for the character of the constituents. This is the "trial method."

The aggregate industry will profit if each operator will make this study for himself for his own materials and those which are offered for sale in competition. It would be a calamity for the individual whose materials have no advantageous inherent characteristics if construction specifications were suddenly adopted which provided for selection of materials as determined by the trial method. Yet, that is the tendency.

The *Crushed Stone Journal*, April, 1930, contains an article by F. H. Jackson, senior engineer of tests, U. S. Bureau of Public Roads. The subject is addressed to the aggregate industry and covers the matter of utilization of aggregates for concrete on a basis of determining the otherwise unmeasurable character of the materials by the trial method under laboratory control. Opinion may differ as to the practicality of such specifications. It is not intended to discuss that problem here. The important thing is that this is one of a great many links in the chain of evidence that the method is being given serious attention. There is reason to believe that in the not far distant future there will be discrimination between materials. A trip into the field will prove that resident engineers have their favorite materials ever in mind.

Determine Now What Can Be Done with Your Materials

Now, therefore, is the time for the operator to begin to investigate the method to determine the influence of inherent characteristics upon present methods of production and marketing. This is important; the time is *now* and not later. It is a matter of record that of 12 plants serving a portion of one state only five survived the general adoption of specifications based on this type of discrimination. The "washed out" investment of these seven plants was about four times that in the other plants. Two of the seven have recently returned to successful production after rehabilitation and refinancing and at substantial loss to the original investors. Such investigations may bring out facts to encourage the producer.

There is no great lack of appreciation of the economic value of the application of concrete knowledge. Fundamentals are pretty generaly understood by the directing heads of design and construction. Evidence to support this statement is found, as Jackson says, in the "new and multiplied specifications for materials that you can't keep up with." There is a lot of similarity between these, but designers' pride prevents standardization. The specifications in Jackson's paper are offered as a step toward standardization and he invites comment thereon.

Mr. Jackson's favorable comment on the method used by the State of California, division of highways, prompts the suggestion that it be used for preparing tests. It requires no expensive equipment or extended experience to secure proper specimens for testing. The testing can be done by commercial laboratories at a small expense and the results can be studied to determine the differences due to different materials, gradings and proportions. Each producer should know the best grading and proportions for his and other materials to assist him in perfecting his processing and in promoting sales. If processing can be developed to improve the inherent characteristics and concrete-making properties of an aggregate, the aggregate could become the standard for specifications.

How Producers Can Get Their Own Specifications

The practitioner's experience is the guide to writing specifications. Testing is done for the purpose of description. Samples are necessary for tests. The tests are usually made on the materials giving desirable results. Therefore, it is easily imaginable that the description given in a set of specifications could be that covering the producer's own product. If the engineer finds that reprocessing the product will give better results, it is possible that the description of the materials will be that covering the reprocessed product; and the owner of the original sample may not recognize that his own raw materials are the basis for the standard of the specifications. The trial method will show how to process materials to get the best results and can be used to determine what to send to the engineer for preliminary testing. In this way the producer gets his own specification.

Since some materials give better results than others, it is necessary that the difference be determined before the value can be established. If the value of materials is found to vary, the sale price must vary and, since the cost of production for all plants is near the same level, the difference between cost of production and sale price will depend upon the value. If new standards of value are created, the difference may be negative. The future, therefore, seems to hold out but little hope for inferior materials.

Contrary to the claim of some aggregate producers, mass production is not a cure for no profits. Even though there are cases where profitable operations have been carried on in prosperous times, the average earnings over periods covering depression

Editor's Note

***STARTING** out with an argument in favor of quality products, the author is soon advocating discrimination vs. standardization; in other words, he would capitalize the superior quality of a particular product, superior knowledge of one's product, salesmanship based on scientific knowledge of the virtues of one's products vs. the shortcomings of competitors' products. The following paragraph, from his own text, summarizes his views:*

"Concrete practice which encourages discrimination is going to be resisted within the industry, but if attempts are made by the industry to protect those members who do not have inherently good materials it will avail them little, for nothing can be done for them. Discriminating practice may be delayed, but it will come eventually. Human nature is selfish and as soon as those possessing inherently more valuable materials recognize their position, exploitation for greater profits will begin. A number of producers are now employing research engineers for the purpose of making investigations along this line. A better understanding of the value of the materials will make for discrimination."

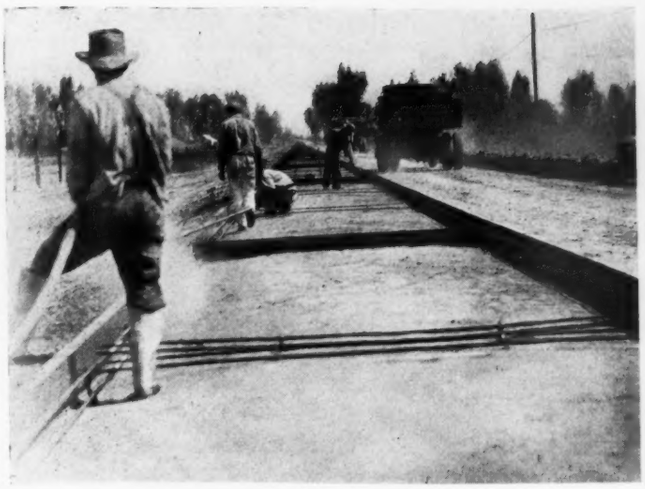


Fig. 1. The theory of stabilizing sizes was incorporated in the 1930 specifications and practice of the State of California. This picture illustrates the "two-strip method" of laying a 20-ft. wide pavement. The strength of the concrete is determined by beam tests if the first strip is to be used for hauling

Fig. 2. The combined mix in the mixer skip. Notice the abundance of 1/4- to 1-in. gravel which was used to stabilize the voids in this material

have been nil. In localities where raw materials are abundant and low standards for products are encountered new plants spring up whenever prices are raised to profitable levels, and these producers are the cut-throat competition in times of depression or in seasonal periods of small demand. This condition is common to all American industry unless the industry looks to the quality of the product.

Not Volume But Quality Should Be Basis of Profit

The degree of prosperity experienced by any industry depends upon the ability of that industry to fit its selling price into the cost sheet of living. The extent to which the producer recognizes that not the volume of production but the ability to produce to fit the requirements of the consuming markets will determine the future of the industry. The technique of processing and selling good aggregates is adaptable to supplementing the present mass production and selling methods, and this phase permits of gradual development, of understanding markets in which discrimination is practiced without any radical and expensive immediate changes. The industry as a whole has made progress to this end.

Transition periods tax the imagination of the business executive. It is difficult to detect when changes are necessary. However this may be, it is not inherent in American business that it should remain still. There will be motion. These movements must of necessity be made cautiously to prevent disaster, but movement there must be to safeguard the financial structure of business. It is reasonable to assume that these movements will be based upon conclusions derived from fact. Human ingenuity and science originate surprises. They also solve the problems that originate in these surprises. Research in the arts and science of commerce will be the chief aid to profitable business. Goldbeck, Walker and others are the watchmen for the aggregate industry. Slowly, but no less surely, their influence is growing. The full application of science will be accelerated as the extent of its influence is acknowledged and facilities are provided for its exploitation. The business awards will go to the business executive who realizes this first.

Those who buy in the open market have changed their attitude toward science in the last decade. There is more intelligence on both sides of the counter. This change has been sensed by the press and promoters. Statements of scientific fact now appear on the billboards and the explanation is left to the press where, as news, it often occupies the headlines.

There is appeal in the logic of science that is new. It is romantic in its adnascence, and interesting in its application. The seller and the buyer are attracted by well prepared selling talks based on scientific fact and each responds to its purpose. The seller is urged to sell and the buyer is urged to buy. This kind of sales effort is good strategy. It breaks down sales resistance.

Scientific Knowledge of Product Is Salable

The exchange value of scientific fact is always high. Preliminary action leading up to expenditures of large amounts of money are for the purpose of obtaining and exploiting facts which are fundamental to the objective. Sales work is made easier by the contacts which are made during this period. It is then that the leaders in the markets possess an open mind. They recognize that the problems are approached from all sides and that co-operation can be inaugurated which will lead to greater mutual satisfaction and profit for all. New and better propaganda can be offered to the politician and promoter, who are always seeking endorsement from organizations. The taxpayer-voter is demanding something besides flag waving on the part of public men, and turns to trade leaders for information. Civic and commercial organizations analyze taxes and special assessments for value received. Well constructed public improvements are profitable for the property owner and are assets to the politician. The successful completion and acceptance of public and private work is conditional upon how well those in charge have hewed to the line.

Architects and engineers recognize the value of co-operative promotion of markets for their arts and science. These men are high type men and carry considerable prestige in their community. They are constantly on their guard against the attempts to use inferior methods and materials. This attitude should be encouraged to limit the field of competition to those materials which have been found to have merit. Supervision based on rigidness is less of a hazard than that based upon slip-shod methods. It puts every one on the same level. An analysis of unfavorable experience between contractors and supervising heads generally shows that divergent opinions had their origin in the failure to get together on permissible practice before the contract was awarded. Certain prerogatives which the supervising heads believe they should retain and which may become a nuisance can be compromised by contact in the initial stages of promotion.

The profits of the engineer and contractor are paronymous. When contacts during the promotional periods of selling have been ethical, and for the owner's benefit, the latch key will be left out by the supervising engineer or architect to all those who are sincere in protecting the owner's interest even though their motives are for personal gain. The owner expects and wants those engaged in construction to make a reasonable profit. The amount of the profit is judged by the service rendered. Salesmen who know their

Fig. 3. Sufficient water to give workability without washing was determined by trial batches in which the proportions were changed until the one requiring the least amount of water to give this condition was determined. This mix contains 36.4% passing a No. 3 sieve, and 72% passing a 1 1/4-in. opening. Compare this mix with Figs. 11 and 12 for washing and segregation

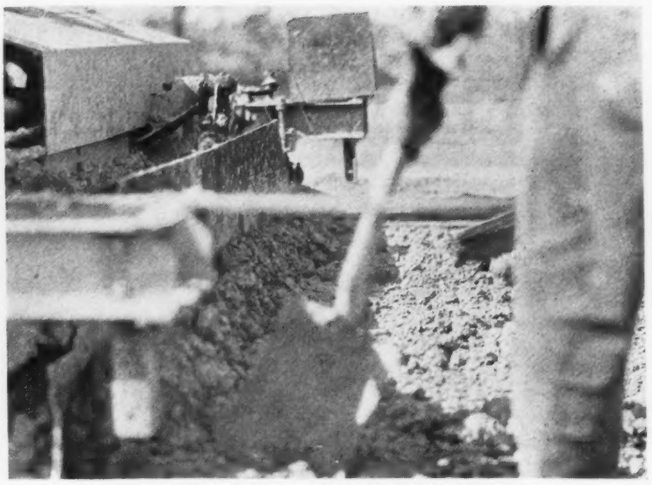


Fig. 4. The finishing machine did not cause segregation. This is the same batch as shown in the opposite picture

product and their product's product are invited to conference with the owner and his technician to point out the science back of the product and its application to the detailed problems which are unfolded as the technician gets his instructions or explains his plans. The owner expects his technician to avail himself of the opportunities offered by manufacturers to study the claims made for goods. The technician's value to his employer is measured by his ability to fit these items into the cost sheet of a structure. When goods are made according to the best standards as set up by the organized industry the sales engineer has no handicap in his product.

Organized Industry Essential

Organized industry, as represented by societies, institutes and associations is for the purpose of bringing and maintaining stability to commerce. The surprises of science are in the future. Commerce is becoming a complex field. The problems which arise must be solved on a basis of the influence of the individual. United exchange of fact and figures is most effective under centralized control. Organization was and is logical.

These organizations have become a great power in daily commercial and social life. Surveys covering territory and production are made. Statistics are gathered and interpretation is placed upon these. Information is secured and contacts are made which do much to remove the destructiveness of fear. The fear of overproduction, of lack of appreciation of a product and of competition warps the judgment of the business executive.

A sense of dependence upon trade organization, upon science, research and intimate relationship is becoming a part of our trade psychology. Great things are expected from the national aggregate organizations. Fact finding and fact dissemination is in demand. Almost every industry is organized and offers the opportunity to meet socially the fellow worker. Such activities as arbitration, advertising, accounting, ethics, standards, credit, legal, research, legislation, processing, publications and instructions are carried out under centralized directorates. The aim of all this is to regulate the growth of industry and commerce to that of the purchasing power of the consumer. If this is done production goes forward and profitable selling prices are maintained.

This price must be protected. The reason is self-evident. In periods of prosperity the field of competition takes on new spheres and larger boundaries. Localized stability invites encroachment. Better transportation and products encourage expansion of markets. Two kinds of competition are noticeable. Intra-industrial competition, where one

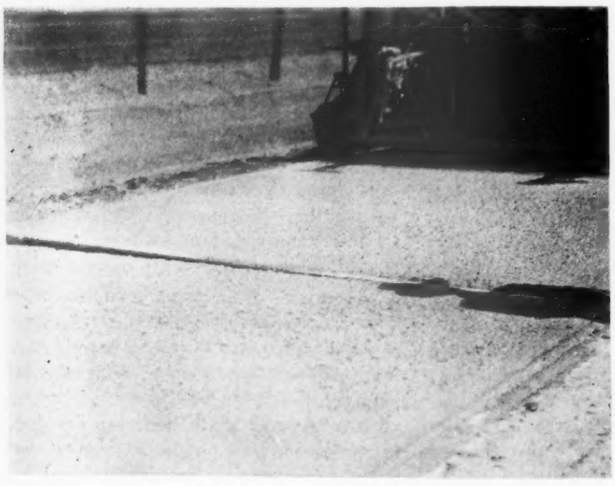


Fig. 5. After the finishing machine passed by, the surface was made up uniformly of fine and coarse materials in which the water content was uniformly distributed. Subsidence is uniform and ample mortar after subsidence permits of minimum labor for longitudinal striking off

Fig. 6. After the strike-off with the longitudinal bull-float the surface yields readily to the action of the straightedge float which follows

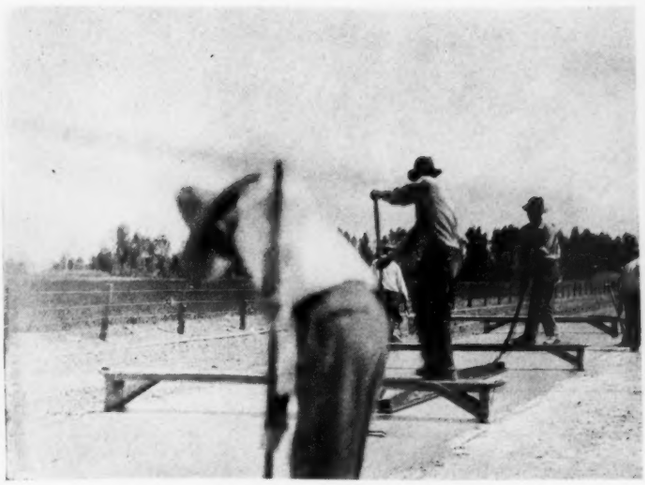


Fig. 7. The straightedge float finishers find ample mortar and a uniform distribution of water content

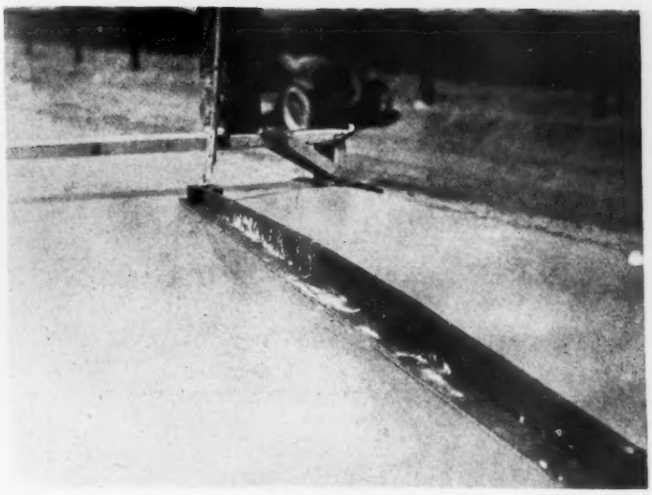


Fig. 8. The surface is uniformly wet and has subsided uniformly over the entire area

producer competes with the producer of like materials; and the inter-industrial competition, where other materials and methods are substituted. The producer of concrete-making materials must still compete with others in the industry; and, in addition, with other lines and their essential processes and products. The research worker develops substitutes. Structural steel, lumber, brick and concrete compete with petroleum products. Changes in product far removed from an industry operate to bring new rivalry for the consumers' dollar. Intra-industrial rivalry broadens into inter-industrial competition. Leaders in the field find their position less secure. Prices must be adjusted. Care must be used that the greater utility of inter-industrial goods does not overlap and usurp the entire field for disposal of older lines.

Waste Caused by Lack of Discrimination

The waste in concrete practice is largely due to the failure of those engaged in the manufacture of the ingredients to encourage discrimination. Concrete of the same quality cannot be made from two different aggregates and two different cements unless the inherent characteristics of the materials are taken into consideration. This is fundamental in concrete science and is recognized by the Portland Cement Association. It is promoting the "trial method of proportioning concrete mixtures." The aggregates are likewise important in asphaltic concrete mixtures. If the trial method were in full effect there would, of necessity, be discrimination between materials and, therefore, there would be a difference in selling prices. Arthur R. Lord, president, Lord and Holinger, Inc., architectural engineers, Chicago, Ill., says: "There is no question in my mind that the economic value of different aggregates varies very markedly and that eventually aggregates producing better concrete will sell at a premium. The difference in value is frequently due to the character of the material quite as much as to the grading characteristics." The writer utilized these characteristics of aggregates as a basis for large profits from the sale of aggregates in a number of cases, some of which were described in Rock Products during 1928 and 1929. In those cases the closest competition was of the inter-industrial type. Brick, tile and plaster offered at the lowest prices permitted us to realize a profit on concrete aggregate equal to the cost of production. The proof of the pudding is in the eating.

Concrete practice that encourages discrimination is going to be resisted within the industry, but if attempts are made by the industry to protect those members who do not have inherently good materials it will avail them little, for nothing can be done for them. Discriminating practice may be delayed, but come it eventually will. Human nature is selfish and as soon as those possessing inherently more valuable materials recognize their position, exploitation for greater profits will begin. A number of producers are now employing research engineers for the purpose of making investigations along this line. A better understand-

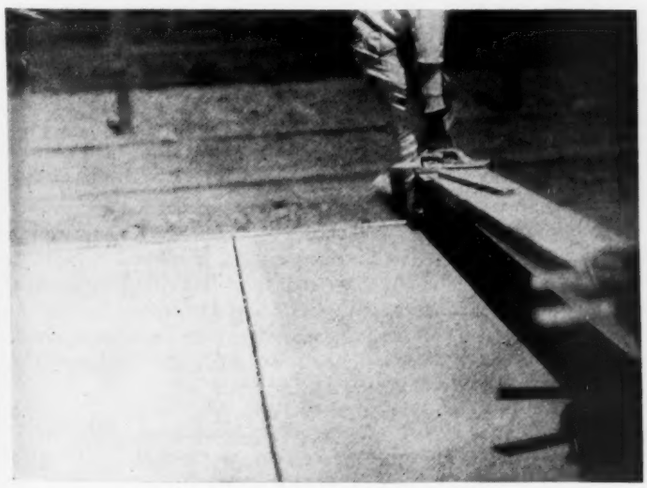


Fig. 9. The joints are easily finished. The marks of the straightedge across the joint show how well this concrete responded to the finishing operation. In panel type construction smooth joints are absolutely necessary

Fig. 10. Field specimens

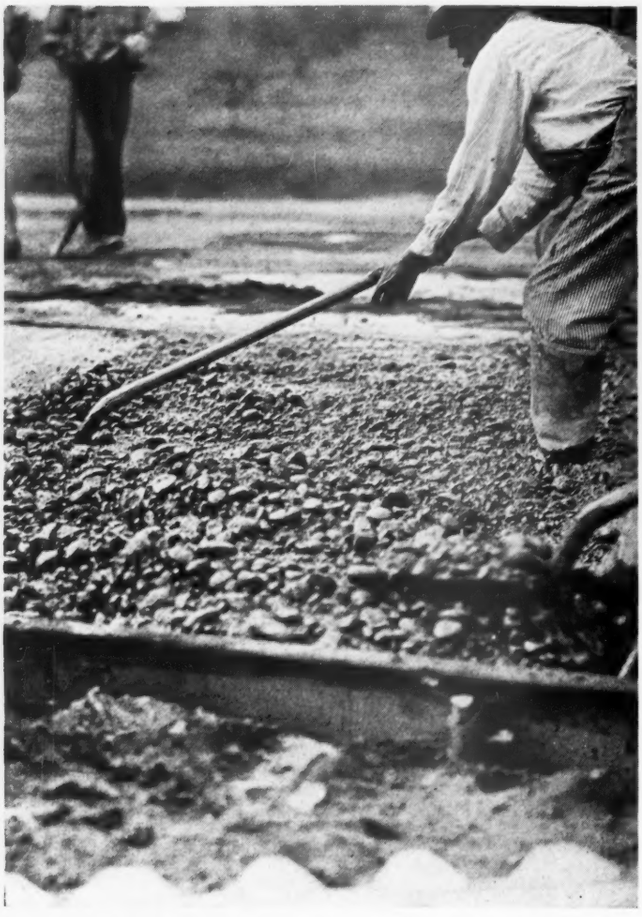


Fig. 11. Concrete for comparison. The effect of the sand was not determined by trial. Workability was secured by the addition of water. The sand fraction was 30% of the combined aggregate. When this was raised to 34.7% better workability with no segregation was secured with a reduction of 7 lb. of water per sack of cement. Compare this picture with Fig. 7. Note the surplus water and other waste of materials on the adjacent slab. There was no such waste in Fig. 7

Fig. 12. Compare this picture with Fig. 4. Note how the finishing machine is producing segregation and the washed appearance of the coarse aggregate. This segregation produces "pop corn" which decreases the effective depth of the slab. Since the permissible wheel loading varies as the square of the depth, it is apparent that this pavement will be inferior to one having the full effective depth

ing of the value of the materials will make for discrimination.

If discrimination based on a difference in the utility of materials is to be encouraged only those materials which will yield quality concrete at a minimum cost should be processed and sold. The producer should create a desire for quality. This desire for quality stimulates the designer's energy and ambition. He becomes an ally in market promotion.

Lack of want is lack of comparison. If one engineer or architect builds well, so will it be the want of others to do likewise. When a new standard of comparison has been created it should be advertised. This advertising must be directed at various consuming sources but, particularly, it should be such as to create a desire for the new standard of comparison. The competition of professional pride should be fostered. The talents of the professional produce new and higher standards. Skill enters into processing and use of materials, and in skill there is monopoly.

Producer Should Assist in Promoting Skillful Use of Materials

Though the higher standards of skill are desirable, they are unobtainable without the assistance of the producer of the materials. The producer of concrete aggregate can well afford to co-operate. If men are working and thinking to maintain themselves at higher professional levels, and these men must have the co-operation of others to do so, it is reasonable to assume that if all are willing, all will be raised to a higher average level. What applies to men applies to tools and methods, regardless of their nature. With the leaders in the construction field working to this end it is at once apparent that this accomplishment in more skill and better quality cannot but assist in the upward trend of prices.

Take stock of the producer's position in this movement. Many glaring faults are uncovered to surprise the operator. As an executive he concentrates all his effort on production. Consumption is not important until it is lacking. At all times during the peak of production work should be done to provide a market. Advertising and salesmanship are the weapons for this. These are the primary defense for quality market and also the urge to change in market demands. If new and better knowledge has come to the producer, which has prompted him to the processing of better aggregates, this new knowledge of products must be passed on to the consumer. If basic values are real and distinct, the consumer will change as did the producer and accept the newer and better product. Advertising in some form is essential to a big market. If a foothold is secured for better products, advertising should be used to bring about sameness in demand. If similarity of desire is created, the market becomes sensitive and appreciative. Not only the engineer and architect but the consumer can be made to desire measurable and comparable quality. Competition based on pride is created. Better products are in demand. A monopoly for this class of products is maintained by the consumer. The universal cure for no profits is to learn the art of producing and selling quality products.

The economic utility of a cubic yard of concrete is measured in terms of price and value. These are not necessarily the same. The fact that there is a difference forms the basis for contention that profits for the producer can be increased without an additional cost to the consumer. Because the aggregates influence the value in use of the concrete the value of the aggregates will be increased if the concrete has greater utility. A premium can be paid for aggregates which give the concrete the quality for greatest use. The choice of materials becomes a matter of fundamental costs against which there is no argument. It remains to show that different materials do influence the quality of the concrete.

Faults of Present Methods of Concrete Control

Before an attempt will be made to show this, some attention should be given to faults in the present methods of measurement, control and interpretation. The big problem in

Fig. 13. Subsidence of this surface will complicate the finishing operation and will be expensive to the contractor. The engineer will not get uniform results. There is a double loss, due to failure to try batches for correct proportions

Fig. 4. Samples marked 6681 contain the same amount of sand by weight as the others. The maximum size of rock in 6681 is 3-in.; that of the others 1 1/2-in. No. 6681 contains six sacks per cu. yd.; the others 5.5 sacks per cu. yd. The strengths in compression are the same. In 6681 the sand was determined on a basis of arbitrarily oversanding the voids in the coarse aggregate. In the other concrete the amount of sand was determined by trial and calculated after workability had been secured. The water content of 6681 was 14% greater than that of the concrete from which the other samples were made

field concrete is to get uniform quality. If uniform quality can be secured, most of the scientific guesses are eliminated and the savings of wasteful practice can be credited to those materials and methods which produce uniform quality.

The need of concrete practitioners is measures. If all the factors which influence the quality of concrete could be measured, control would be easy. Most efforts along this line fail to take into account inherent and unmeasurable characteristics. G. H. P. Lichthardt, testing engineer, in charge of the chemical department of the Division of Highways, State of California, has done some work on measuring these inherent characteristics which may be available soon. Also the division of fine and coarse aggregates is responsible for unsuited practice in processing and proportioning. Producers are afraid of limited tolerances and certain essential sizes are not in the aggregates. If the full utility of aggregates is to be realized, the practitioner must learn the value of these missing sizes.

A method of proportioning concrete mixtures which measures the effect of different aggregates is used by the California Division of Highways. The method permits of quick conversion to weights and correction of proportions to give workability. Nothing is assumed as final until the concrete has been actually placed and checked for yield. The experience on the larger jobs enables the resident engineer to get very close results on the smaller ones. The first concrete placed is considered "trial concrete" and proportions are changed to get the best workability with a minimum amount of mixing water. The cement content is fixed.

Selection of Sand Important

This method has developed some interesting facts about combining fine and coarse aggregates and indicates the wide range of proportions which are derived for different materials using the same cement content and the same degree of workability. It also reveals the necessity of selectivity of sands if workability is to be secured with a minimum water content. For some sands it has been observed that an increase of 5% of the combined mix has lowered the amount of mixing water from 50 lb. to 42 lb. per sack of cement. This fact is not necessarily in conflict with accepted ideas, but it has established a new conception in the field as to the need for changing the proportions to decrease the water when the cement content is fixed.

The difference in the effect of different sands is not always appreciated by engineers and producers. Too often concrete practice provides for the use of sand regardless of its influence upon workability. It is often assumed that to add more sand would be to add more water. This is not necessarily true. Some sands will combine with coarse aggregates in varying amounts to change the voids in the combined mix. The correct amount for one sand may not be the same for another. If the combination will decrease the voids in the combined mix, this will offset the increase in surface area.

It has been observed that trial batches based on 20% oversanding the voids in the coarse aggregate required approximately 50 lb. of water per sack, but when the voids were oversanded 30% with the same sand, the workability was secured with approximately 45 lb. per sack. Workability is secured with sand and water when the cement is fixed and each sand has its peculiar action and effect. The California method utilizes the phenomenon of flowability of sand as well as other unmeasurable characteristics such as surface and shape. It is a method

TABLE I. CHARACTERISTICS OF SAND FOR STABILIZING AGGREGATE

Sand A.	100% passing No. 3.	Weight	101.87 lb. per cu. ft.
	80% passing No. 10.	S. G.	2.73
	35% passing No. 30.	Voids	40%
Sand B.	100% passing No. 3.	Weight	103.37 lb. per cu. ft.
	75% passing No. 10.	S. G.	2.72
	25% passing No. 30.	Voids	39.2%
Sand C.	100% passing No. 3.	Weight	104.12 lb. per cu. ft.
	65% passing No. 10.	S. G.	2.72
	15% passing No. 30.	Voids	38.8%

TABLE II. CHARACTERISTICS OF COARSE AGGREGATES USED TO DETERMINE STABILIZING INFLUENCE

Screen size	Fine gravel	Coarse gravel
2½-in.	100% passing	100% passing
2- in.	100% passing	90% passing
1½-in.	100% passing	85% passing
1¼-in.	75% passing	75% passing
1- in.	60% passing	60% passing
¾-in.	55% passing	55% passing
½-in.	35% passing	35% passing
⅜-in.	20% passing	20% passing
No. 3	0% passing	0% passing

Percentage of voids, fine rock 35.9%. Weight per cu. ft. 113.4 lb.
Percentage of voids, coarse rock 35.4%. Weight per cu. ft. 114.4 lb.

TABLE III. COMPRESSION TESTS TO DETERMINE STABILIZING INFLUENCE OF A FIXED SIZE COARSE AGGREGATE—BROKEN AT 8 DAYS

Test No.	Sand 100% past No. 3 Past 10	Past 30	Proportions—Voids + 20% By volume CMT	Sand	Rock	Test weights CMT	Sand	Rock	Max. rock, in.	Water Test c.c.	Pounds sack	W/C	Concrete Slump, in.	Total load	Lb./sq. in.	Avge. lb./sq. in.	Mortar strength Indiv. lb./sq. in.	Average Mixer	Hand made
	Per cent																		
1	80	35	1	1.57	3.65	12.8	21.9	56.7	1½	2600	42.0	.67	1	113,700	4195	.....	5649	5730	7094
2	80	35	1	1.57	3.65	12.8	21.9	56.7	1½	2600	42.0	.67	1	96,800	3570	.....	5812	.....	.....
3	80	35	1	1.57	3.65	12.8	21.9	56.7	1½	2600	42.0	.67	1	98,700	3640	3801	.....	.....	.....
4	75	25	1	1.57	3.64	12.9	22.3	56.7	1½	2550	41.0	.65	1¼	97,600	3600	.....	5812	5768	7451
5	75	25	1	1.57	3.64	12.9	22.3	56.7	1½	2550	41.0	.65	1¼	97,300	3590	.....	5909	.....	.....
6	75	25	1	1.57	3.64	12.9	22.3	56.7	1½	2550	41.0	.65	1¼	103,600	3820	3670	5585	.....	.....
7	65	15	1	1.56	3.63	12.9	22.4	56.7	1½	2510	40.4	.64	½	112,400	4145	.....	5260	5244	7430
8	65	15	1	1.56	3.63	12.9	22.4	56.7	1½	2510	40.4	.64	½	111,700	4120	.....	5227	.....	.....
9	65	15	1	1.56	3.63	12.9	22.4	56.7	1½	2510	40.4	.64	½	117,400	4330	4198	.....	.....	.....
10	65	15	1	1.65*	3.54	13.25	24.25	56.7	1½	2670	41.7	.67	½	114,300	4215	.....	5585	5552	7121
11	65	15	1	1.65*	3.54	13.25	24.25	56.7	1½	2670	41.7	.67	¼	115,000	4240	.....	5520	.....	.....
12	65	15	1	1.65*	3.54	13.25	24.25	56.7	1½	2670	41.7	.67	½	111,500	4115	4190	5552	.....	.....
13	80	35	1	1.55	3.64	12.9	21.7	57.2	2½	2600	41.7	.67	⅞	113,300	4180	.....	5941	6136	7310
14	80	35	1	1.55	3.64	12.9	21.7	57.2	2½	2600	41.7	.67	⅞	119,500	4415	.....	6136	.....	.....
15	80	35	1	1.55	3.64	12.9	21.7	57.2	2½	2600	41.7	.67	⅞	111,300	4105	4233	6331	.....	.....
16	75	25	1	1.54	3.63	12.9	21.9	57.2	2½	2650	42.5	.68	1	112,700	4155	.....	6039	5995	7300
17	75	25	1	1.54	3.63	12.9	21.9	57.2	2½	2650	42.5	.68	1	111,400	4110	.....	5941	.....	.....
18	75	25	1	1.54	3.63	12.9	21.9	57.2	2½	2650	42.5	.68	1	105,400	3890	4025	6006	.....	.....
19	65	15	1	1.54	3.62	13.0	22.0	57.2	2½	2550	40.5	.65	¾	105,900	3905	.....	6916	6785	7792
20	65	15	1	1.54	3.62	13.0	22.0	57.2	2½	2550	40.5	.65	¾	112,200	4140	.....	6753	.....	.....
21	65	15	1	1.54	3.62	13.0	22.0	57.2	2½	2550	40.5	.65	¾	114,000	4110	4052	6688	.....	.....
22	65	15	1	1.98†	3.55	13.25	28.9	57.2	2½	2950	46.0	.73	¾	102,400	3775	.....	5552	5465	.....
23	65	15	1	1.98†	3.55	13.25	28.9	57.2	2½	2950	46.0	.73	¾	100,300	3700	.....	5422	.....	.....
24	65	15	1	1.98†	3.55	13.25	28.9	57.2	2½	2950	46.0	.73	¾	103,100	3805	3793	5422	.....	.....
25	65	15	1	1.63*	3.55	13.25	23.74	57.2	2½	2660	41.5	.66	¾	93,700	3455	.....	5585	5162	7077
26	65	15	1	1.63*	3.55	13.25	23.74	57.2	2½	2660	41.5	.66	¾	111,600	4115	.....	5357	.....	.....
27	65	15	1	1.63*	3.55	13.25	23.74	57.2	2½	2660	41.5	.66	¾	120,400	4440	4003	4545	.....	.....

*Voids + 30%.
†Voids + 58% — 5.62 sacks.

Average 3995
High 4440
Low 3455

Range 995

$$\text{Per cent } \frac{\text{Range}}{\text{Average}} = 25\%$$

Average 5741

of approximating the correct proportions by predetermining the grading and voids in the combined aggregates. The interpretation of the mechanical tests is based on technique, but the last analysis of the correctness of the mix is determined by trial. The proportion requiring the least amount of water per sack of cement to give proper workability is final.

Design of California Highway Mix

In order that a detailed knowledge of the method can be secured, the design of mixtures is given and the results of breaks are given in the tables. There are, of necessity, certain facts which must be taken for granted, such as the interpretation of workability. The strengths are so nearly the same for 28-day results that the wrong conclusions might be possible. The grading of the sands and the amount of sand used had a very noticeable effect upon the workability for the same water-cement ratio. For the 8-day results it is very true that, if the same degree of workability had been secured for the different mixes, the ratio would have varied more. It is the action of water and sand with respect to workability that is important in field concrete.

For the purpose of this test, sand and gravel were secured from commercial sources and reprocessed to give the screen tests shown in Tables I and II.

It will be observed that the percentage of voids for each of the coarse aggregates is the same regardless of the maximum size. Each of these gravels is from the same source. This void condition is important. It is the basis for the division of sizes which are recombined in the batching of field proportions. Experience indicates that for each source of supply there is a limited range of sizes which, if added in definite amount to the combined mix, will stabilize the voids regardless of the range in sizes for the rest of the coarse aggregates. Therefore, if three-compartment bins are used and ¼-in. to 1-in. stone is the range of the stabilizing sizes for the material which it is proposed to use, one compartment is used for this stabilizing size, one for sand and one for the balance of the coarse aggregate. It is not claimed that the amount of this stabilizing size is the same as that which would give minimum voids in the combined coarse aggregate, but it has been shown that if this limited range of sizes is always the same by weight the voids do not change, no matter what the range in amounts of other size may be, so long as some of all sizes are present. This insures the effectiveness of the proportions, which is a big step in field control.

Observations to date confirm the opinion that the difference in the proportions of the two coarse aggregates to stabilize the voids and to give minimum voids in the combined aggregates is not great and is negligible when it is remembered that the final proportions are determined after the effect of various parts of sand has been determined by the various trials. The method of design which is used does not presuppose that the voids in the combined coarse portion of the mix are much of an index to the voids in the combined mix. It is not assumed that the effect of mixing water upon the combined mix can be predetermined. It is assumed and proved by practice that the proportions are correct only so long as a change in grading does not materially change the voids in the combined mix.

Uniformity the Goal

In field control the voids are of primary importance, not from the standpoint of minimums but from the standpoint of uniformity. Therefore, any method which will give uniform voids is preferable to one giving minimum voids, if the voids cannot be maintained uniformly. There can be no variation in grading which will change the voids if the proportions are not to be changed. For this material, if all the sizes between ¼- and 1¼-in. is delivered to one compartment of the bins and 60% of the total coarse aggregate is weighed out of this compartment, the balance of the sizes can vary from 1½-in. to 2½-in. and the voids in the combined coarse aggregate will not vary except from 35.9% for the 1½-in. to 35.4% for the 2½-in. maximum. This variation is negligible.

The proportions are designed from the weights and voids as follows:

Let X equal the number of cubic feet of coarse aggregate to be used per sack of cement.

V equals the percentage of voids in the coarse aggregate.

v equals the percentage of voids in the fine aggregate.

p equals the percentage of oversanding of the voids in the coarse aggregate.

Then V plus pV equals the cubic feet of sand per cubic foot of C.A.

The proportions are $1 : XV\ (1 \text{ plus } p) : X$. Convert to absolute volume to determine yield:

$$\frac{(0.47 \text{ plus } d\ (XV\ (1 \text{ plus } p) \text{ plus } DX)\ N}{f}$$

equals 27 cu. ft.

When N is the number of sacks of cement per cubic yard, d equals $1\text{-}v$, D equals $1\text{-}V$, and f is a yield factor which varies from 0.83 for structures to 0.88 for pavements.

The percentage of fine and coarse are obtained by converting the proportions to weights. The combined grading curve is obtained by adding the percentage of each of the sizes in the separate gradings which

is the product of the percentage passing the individual screens times the percentage of the material used in the proportions.

Since the quantity X appears in the sand portion of the mix, any change in the amount of coarse aggregate makes a change in the fine aggregate portion. This permits the investigator to follow the relationship of fine to coarse to determine the influence of changing proportions when the yield and grading are fixed.

Using the 1½-in. maximum size aggregate, the voids (being 35.9%) are oversanded 20% for specimens 1 to 9, Table III. The procedure follows: For each cubic foot of coarse aggregate the sand requirement will be 0.359 cu. ft. plus 20% of 0.359 cu. ft., or 0.43 cu. ft. of sand. The next step is to assume a value of X, which will be taken at 3.65 cu. ft. The total sand portion will be 3.65 times the 0.43 cu. ft. or 1.57 cu. ft. The proportion for trial yield is 1:1.57:3.65 by volume. This is calculated for absolute volume:

$$1 \times 0.47 = 0.47$$
$$1.57 \times 0.60 = 0.942$$
$$3.65 \times 0.641 = 2.33$$
$$3.742$$
$$\frac{3.74 \times 6}{0.83} = 27 \text{ cu. ft. for 6 sacks of cement.}$$

This method gives the same proportions for all materials having the same percentage of voids when the voids are oversanded the same. Table III gives the headings to identify the origin of the proportions.

Factors Controlling Workability

The results of these tests show that the workability of the concrete is influenced very markedly by the percentage of sand and by the grading of the sand. The grading of the coarse aggregate likewise influences the workability. This was determined from the proportions designed from oversanding 20% and using each of the coarse sizes. If the same strength and workability are required with two sands showing different grading characteristics, the proportions must be adjusted. The same proportions will result in a change in water which will change the strength when cement content is fixed. It is considered unlikely that inherent characteristics of sands will always compensate for the difference in grading. Attempts were made to determine the effect upon the voids in the combined aggregates of fixed sand content which sand showed different gradings. The results were very erratic and were rejected.

Specimens 10 to 12 inclusive were made from proportions calculated by oversanding 30% with the coarse sand C. This mix required more water than for the 20% oversanded mix, but the strengths are about the same. This is explained as due to the

TABLE IV. TABLE COMPARING CONCRETE, CONCRETE MIXER AND HAND MADE MORTAR—8 DAYS

Mix		Max. size aggregate in.	Concrete average	Screened mortar: Voids + 20% Per cent	Screened mortar: Voids + 30%	Screened mortar: Voids + 58%	Ratio mortar concrete	W/C	Hand made mortar: 20% void	Hand made mortar: 30% plus	Hand made mortar: Per cent	Hand made mortar: Per cent	Ratio mortar concrete Per cent
1–1.57	Sand A	1½	3801	5730	93.5	.....	.....	.....	65.7	.67	7094	.....	98	98	53.7
1–1.53		2½	4233	6138	100	.....	.....	.....	68.8	.67	7310	.....	100	100	58.0
1–1.57	Sand B	1½	3670	5768	90	.....	.....	.....	63.6	.65	7451	.....	102	102	49.2
1–1.54		2½	4025	5995	100	.....	.....	.....	67.0	.68	7300	.....	100	100	55
1–1.56	Sand C	1½	4198	5244	87.6	.....	.....	.....	72.5	.64	7430	.....	95.3	95.3	56.8
1–1.54		2½	4025	5995	100	.....	.....	.....	67.1	.65	7792	.....	100	100	52
1–1.65	Sand C	1½	4190	.....	.....	5552	107.5	.....	75.4	.67	.....	7121	100.6	100.6	59
1–1.63		2½	4003	.....	.....	5162	100	.....	76.5	.66	.....	7077	100	100	56.8
											7383	7099			
1–1.98	Sand C	2½	3793	.....	.....	.....	.....	5162*	73.6	.73	Ave. 7322				54
		Average	3996	5907	Average all concrete mortars			5644	Ratio all concrete mortar to concrete 70%, to hand mortar 54%						

*Yield = 5.62 sacks.

4198 lb. / 12,840 Y. — 20% sand with 1½-in. — 30% / 30% sand with 1½-in. — 20% / 12,707 Y. / 4190 lb.

4003 lb. / 12,700 Y. — Sand C with 2½-in. / Sand C with 2½-in. / 12,870 Y. / 4025 lb.

} Comparison of weight and strength of 7, 8, 9, 10, 11, 12, 19, 20, 21, 25, 26, 27

1—With sand C the strengths are the same regardless of the maximum size aggregate or the percentage of sand required with the mortar ratios of 1:54 to 1:1.65.
2—With sand A and B the concrete strengths are obtained with the larger aggregate, the highest with sand C and small stone.
3—Oversanding the large rock voids 58% with sand C gives approximately the same strengths as did oversanding the small rock 20% with sand A or B.
4—The highest (4440 lb.) and the lowest (3455 lb.) for the 27 specimens occurred in the same batch represented by specimens 25-26-27 and if these two are not considered the range for all individual strengths is 19% of the lowest and 15% of the highest breaks.
5—For all practical purposes the strengths are same and average 3996 lb. per sq. in. for 8-day concrete and the range in strength 10% from the average. However, some of the mixes are more workable than others.

TABLE V. COMPRESSION TESTS TO DETERMINE STABILIZING INFLUENCE OF A FIXED COARSE AGGREGATE
(Made 1-29-30; broken 2-26-30; age 28 days)

Test No.	Sand: 100% past No. 3 Past 10 Per cent	Past 30 Per cent	Proportions—Voids + 20%: By volume CMT	Sand	Rock	Test weights: CMT	Sand	Rock	Max. rock, in.	Water: Test c.c.	Pounds sack	W/C	Concrete: Slump, in.	Total load	Lb./ sq. in.	Avge. lb./ sq. in.	Mortar: Mix. made lb./ sq. in.	Avge. lb./ sq. in.	Per cent con. to concrete mortar
1	80	35	1	1.57	3.65	12.8	21.9	56.7	1½	2780	45.0	.72	1¼	154,400	5695	.....	7987	.....	....
2	80	35	1	1.57	3.65	12.8	21.9	56.7	1½	2780	45.0	.72	1¼	141,600	5225	.....	7857	.....	....
3	80	35	1	1.57	3.65	12.8	21.9	56.7	1½	2780	45.0	.72	1¼	153,400	5660	5527	.....	7922	70
4	75	25	1	1.57	3.64	12.9	22.3	56.7	1½	2810	45.0	.72	1	138,600	5115	.....	8345	.....	....
5	75	25	1	1.57	3.64	12.9	22.3	56.7	1½	2810	45.0	.72	1	147,900	5455	.....	8317	.....	....
6	75	25	1	1.57	3.64	12.9	22.3	56.7	1½	2810	45.0	.72	1	159,600	5890	5487	8117	8282	67
7	65	15	1	1.56	3.63	12.9	22.4	56.7	1½	2810	45.0	.72	¾	142,000	5240	.....	9091	.....	....
8	65	15	1	1.56	3.63	12.9	22.4	56.7	1½	2810	45.0	.72	¾	144,700	5340	.....	8864	.....	....
9	65	15	1	1.56	3.63	12.9	22.4	56.7	1½	2810	45.0	.72	¾	139,700	5155	5245	8962	8972	58
10	65	15	1	1.65*	3.54	13.25	24.25	56.7	1½	2880	45.0	.72	1	147,000	5420	.....	7597	.....	....
11	65	15	1	1.65*	3.54	13.25	24.25	56.7	1½	2880	45.0	.72	1	147,700	5450	.....	7013	.....	....
12	65	15	1	1.65*	3.54	13.25	24.25	56.7	1½	2880	45.0	.72	1	139,500	5145	5338	7078	7229	74
13	80	35	1	1.55	3.64	12.9	21.7	57.2	2½	2810	45.0	.72	1½	143,300	5285	.....	7890	.....	....
14	80	35	1	1.55	3.64	12.9	21.7	57.2	2½	2810	45.0	.72	1½	145,100	5355	.....	8345	.....	....
15	80	35	1	1.55	3.64	12.9	21.7	57.2	2½	2810	45.0	.72	1½	141,600	5225	5283	7857	8031	66
16	75	25	1	1.54	3.63	12.9	21.9	57.2	2½	2810	45.0	.72	¾	138,400	5105	.....	7955	.....	....
17	75	25	1	1.54	3.63	12.9	21.9	57.2	2½	2810	45.0	.72	¾	147,900	5455	.....	7338	.....	....
18	75	25	1	1.54	3.63	12.9	21.9	57.2	2½	2810	45.0	.72	¾	149,100	5500	5353	8345	7843	68
19	65	15	1	1.54	3.62	13.0	22.0	57.2	2½	2820	45.0	.72	¾	154,500	5700	.....	7695	.....	....
20	65	15	1	1.54	3.62	13.0	22.0	57.2	2½	2820	45.0	.72	¾	140,200	5170	.....	8182	.....	....
21	65	15	1	1.54	3.62	13.0	22.0	57.2	2½	2820	45.0	.72	¾	137,700	5080	5317	7857	7911	67
22	65	15	1	1.98†	3.55	13.25	28.9	57.2	2½	2880	45.0	.72	.....	.....	.....	.....	.....	.....	....
23	65	15	1	1.98†	3.55	13.25	28.9	57.2	2½	2880	45.0	.72	.....	.....	.....	.....	.....	.....	....
24	65	15	1	1.98†	3.55	13.25	28.9	57.2	2½	2880	45.0	.72	.....	.....	.....	.....	.....	.....	....
25	65	15	1	1.63*	3.55	13.25	23.74	57.2	2½	2880	45.0	.72	1⅛	150,900	5565	.....	6591	.....	....
26	65	15	1	1.63*	3.55	13.25	23.74	57.2	2½	2880	45.0	.72	1⅛	149,300	5508	.....	6851	.....	....
27	65	15	1	1.63*	3.55	13.25	23.74	57.2	2½	2880	45.0	.72	1⅛	150,200	5540	5534	6721	6721	82
											High 5890; low 5080; range 810; average 5385; ratio 15%								
										Same as 16-17-18 except use water 50-lb. sack		.80	2¾	124,900	4605	.....	7370	.....	....
												.80	2¾	128,500	4740	.....	6851	.....	....
												.80	2¾	132,400	4885	4743	7760	7327	65
										Same as 16-17-8 except use water 55-lb. sack		.87	6	110,600	4080	.....	6590	.....	....
												.87	6	103,100	3805	.....	6851	.....	....
												.87	6	102,700	3790	3892	6721	6721	58

*Voids + 30%.
†Voids + 58% — 5.62 sacks.

lesser amount of coarse aggregate which is required when the sand is increased. The mortars show that increasing the sand content and reducing the coarse aggregate content increases the strength if it is not necessary to change the water-cement ratio. Water cement paste gives higher strengths with the fine aggregates than with combined aggregates. The columns headed "Mortar Strengths" in Table III show this relationship. The mixer mortar is screened from the concrete through a ⅜-in. screen. The hand-made mortar was mixed by regular laboratory methods using the same sand-cement mortar and water-cement ratio that was used in the concrete. Table IV gives these results in terms of percentage.

Specimens 22 to 24 were made from concrete derived from proportions in which the voids in the coarse aggregate were oversanded 58%. Table III shows that this coarse sand produced concrete equal in strength to that produced by oversanding with fine sand 20%. The yield is more. If market prices are applied to this mix it can be seen that there is considerable difference in the value of the two sands. After watching the mixing and working of this concrete it was concluded that sand has a lot to do with the workability of concrete with a fixed cement and water content. Therefore a second test was prepared in which the *W/C* ratio was made constant. The results are given in Table V.

Table V includes the results of two tests in which 50 and 55 lb. of water were used. These are given at the bottom of the table and are not numbered. The effect of the additional water is apparent. The tests indicate that for the same proportions the workability is influenced by the sand grading and by the proportions. The addition of certain sands can be made without increasing the water if the coarse aggregate is reduced. The smaller coarse aggregates give a more workable mix than the large size for all sands. The workability of the concrete made by oversanding 30% with the coarse sand was greater than that for the same sand using 20% oversand. This bears out the conclusions that harshness, due to coarse sand, can be eliminated by using more sand.

TABLE Va. COMPARING CONCRETE AND CONCRETE MIXER MORTAR
(AGE 28 DAYS)
(Tests results on stabilizing sizes of coarse aggregate and sand grading)

	Mix		Max. size aggregate	Concrete average	Mortar voids + 20%	Average voids + 30%	Water per sack, lb.	Ratio concrete / mortar, per cent	W / C	Slump: Concrete, inches	Slump: Mortar, inches
1–1.57	Sand	A....	1½	5527	7922	.....	45	70	0.72	1¼	4
1–1.55	Sand	A....	2½	5283	8031	.....	45	66	0.72	1½	4
1–1.57	Sand	B....	1½	5487	8282	.....	45	67	0.72	1	3⅞
1–1.54	Sand	B....	2½	5353	7843	.....	45	68	0.72	¾	3⅞
1–1.56	Sand	C....	1½	5245	8972	.....	45	58	0.72	¾	3⅞
1–1.54	Sand	C....	2½	5317	7911	.....	45	67	0.72	¾	3⅞
1–1.65	Sand	C....	1½	5338	.....	7229	45	74	0.72	1	3¾
1–1.63	Sand	C....	2½	5534	.....	6721	45	82	0.72	1⅛	3¾
			Average	5385	8160	6975					
1–1.54	Sand	B....	2½	4743*	7327	.....	50	65	0.80	2¾	.....
1–1.54	Sand	B....	2½	3892†	6721	.....	55	58	0.87	6	.....

*50 lb. of water per sack.
†55 lb. of water per sack.

1—For the same water, 8 + 28 day breaks the strengths are the same regardless of maximum size of aggregate.
2—The ratio of the concrete to mortar is the same for 20% oversanding the voids at 8 and 28 days.
3—The ratio of concrete to mortar for 30% oversanding is higher than for 20% oversanding for 8 and 28 days.
4—The oversanding of the voids 30% with sand C produces concrete of higher strengths at 8 and 28 days than oversanding the voids 20% with sand C. The mortar for 30% oversand is weaker than 20% oversand, but the concrete is stronger. Showing that for this coarse sand higher strengths and greater workability can be secured by increasing the amount of sand.
5—Water has more influence upon the strengths than any other factor for the same proportions and materials.
6—Increasing the water content from 45 lb. to 50 lb. decreases the concrete strengths 642 lb., 12%, and the mortar 743 lb., 9%. Increasing the water content from 50 lb. to 55 lb. decreases the concrete strengths 651 lb., 18%, and the mortar 606 lb., 8%.
7—Better strengths can be secured by increasing the sand to get workability than by increasing the water.
8—Increasing the sand fraction does not necessarily increase the water required for a given slump when the yield is fixed. Sand A gives greater slump for these coarse aggregates than sand C.

Where Preferred Aggregates Come In

Designing the proportions to fit the grading and other characteristics has certain advantages over the other method, which are fundamental in establishing a preference for materials. California experience shows that

Workability of concrete can be secured for a mixture in which the cement and water is fixed in three ways:

1. By changing the sand grading.
2. By changing the sand portion.
3. By changing grading and proportion.

This means that the grading must fit the proportions or the proportions must be made to fit the grading.

the amount of sand which is required to give maximum workability with a minimum water will vary from 30 to 40% of the total aggregates. The sand characteristics influence the water more than the coarse aggregates, but both must be considered together. It has been observed that there is little difference in the required percentage of oversanding when two different coarse aggregates are used if the voids in the coarse materials are the same, but if two different sands are used with the same coarse aggregate there is considerable difference in the amount of sand required to give the same workability. Field practice indicates the need for studying closely the grading curves on each side of the division size between fine and coarse or between any two ranges of sizes that may be furnished for blends.

The practice of dividing materials into

TABLE VI—SUMMARY OF 8 AND 28-DAY CONCRETE AND MORTAR
(Tests to determine the effect of stabilizing sizes of coarse aggregate and sand upon the strength of concrete)
(Demonstration at Headquarters Conference of District Construction Engineers, State of California, Division of Highways)
Comparison of concrete and concrete mortar strengths

Line No.	Iden.	Sand % voids added	Max. size agg.	Proportions C	S	G	W/C	Age 8 days: Conc. ave.	Mixer mortar	Hand-mixed mortar	W/C	Ratio: Conc. mixer	Conc. hand	Mixer hand	W/C	Age 28 days: Conc. ave.	Mixer mortar	Hand mixed mortar	Ratio: Conc. mix	Conc. hand	Mixer hand	8 Ratio — 28: Conc. ave.	Mix mortar	Hand mortar
1	A	20	1½-in.	1	1.57	3.65	0.67	3801	5730	7094	0.59	66.0	53.6	80.8	0.72	5527	7922	7700	69.9	72.0	103.0	68.6	72.3	92.2
2	B	20	1½-in.	1	1.57	3.64	0.65	3670	5768	7451	0.58	63.6	49.3	76.6	0.72	5487	8282	7619	68.2	72.0	108.5	66.2	69.7	97.6
3	C	20	1½-in.	1	1.56	3.63	0.64	4198	5244	7430	0.55	80.0	51.5	70.6	0.72	5245	8972	7224	58.5	72.6	124.1	73.0	58.5	103.0
4	C	30	1½-in.	1	1.65	3.54	0.67	4190	5552	7121	0.58	80.0	59.0	78.0	0.72	5338	7229	7472	73.6	71.5	96.8	71.8	76.8	95.4
5			1½-in.		Average			3965	5572	7274	.....	.....	.....	.....	.....	5399	8101	7504	.....	.....	.....	.....	.....	.....
6	Average strength of concrete using 20% oversanding—3890 lb. for 8 days; 5420 lb. for 28 days; max. size agg., 1½-in.																							
7	Average strength of concrete using 30% oversanding—4190 lb. for 8 days; 5338 lb. for 28 days; max. size agg., 1½ in.																							
8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	A	20	2½-in.	1	1.55	3.64	0.67	4233	6136	7310	0.59	69.0	58.0	84.0	0.72	5283	8031	7494	65.8	70.5	107.1	79.8	84.0	97.6
11	B	20	2½-in.	1	1.54	3.63	0.68	4025	5995	7300	0.57	66.8	54.8	82.0	0.72	5353	7843	7570	68.2	70.7	103.6	75.0	76.4	96.5
12	C	20	2½-in.	1	1.54	3.62	0.65	4052	6785	7792	0.55	59.0	51.2	87.0	0.72	5317	7911	7581	67.2	70.2	108.0	75.3	85.7	103.0
13	C	30	2½-in.	1	1.63	3.55	0.66	4003	5162	7072	0.59	77.5	56.6	73.0	0.72	5534	6721	7613	82.3	73.0	85.0	77.3	84.2	93.0
14	C*	58	2½-in.	1	1.98	3.55	0.73	3795	5465	7370	.....	.....	.....	.....	.....	5372	7627	.....	.....	.....	.....	.....	.....	.....
15					Average			4022†	6020†	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	Average strength of concrete using 20% oversanding—4103 lb. for 8 days; 5318 lb. for 28 days; max. size agg., 2½ in.																							
17	Average strength of concrete using 30% oversanding—4003 lb. for 8 days; 5534 lb. for 28 days; max. size agg., 2½-in.																							
18*	Average strength of concrete using 58% oversanding—3795 lb. for 8 days.																							
19	*5.62 sacks per cu. yd.																							
20	†Not including 3795 + 5465.																							
21	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	C	20	2½-in.	1	1.54	3.63	.....	.....	.....	.....	.....	.....	.....	.....	0.80	4743	7327	.....	.....	.....	.....	.....	.....	.....
23	C	20	2½-in.	1	1.54	3.63	.....	.....	.....	.....	.....	.....	.....	.....	0.87	3892	6721	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

These results indicate that when stabilizing sizes are used the maximum size aggregate is of little, if any, importance for securing high strength and that the character of the sand is of greatest importance because of its influence upon the water required to give a workable mix. For sand C the voids may be oversanded 20% or 30% without influencing the strengths. Higher sand fraction gives greater uniformity.

groups is a disadvantage. The sizes immediately around the division size are too often missing. These sizes may be the sizes that are necessary to make good mixtures. Producers are afraid of the limited tolerance which is allowed, and process their materials to prevent rejection due to exceeding this tolerance. Specifications should be written to insure the delivery of all the sizes required to give a straight line through these points. The tolerance should be removed, or intermediate sizes should be furnished to blend the groups together. The sizes from 10-mesh to ¾-in. are essential to securing uniform and workable concrete with a minimum amount of mixing water. These sizes influence the mixing time and on paving work the mixing time is an important factor.

Considerable time has been given to grading, showing high percentages in the end fractions. These gradings seem to give low voids. Some experience with such mixes shows the need for longer mixing time which, in some cases, has been found to be twice that required for mixes in which there was an abundance of intermediate sizes. This fact should offer sufficient reason for rejecting high end fraction gradings. The voids need not be at a minimum to get good concrete. About 50% of the mix should be made up with intermediate sizes.

Screen analysis is helpful in predetermining proportions and should be studied in connection with all mixes which give good results. If proper sizes are selected and used in the correct amount to give workability there will be little adjustment except for yield. Also, there will be little to choose between gravel and crushed stone.

If a large number of engineers are employed in putting together a wide range of sizes and varieties of materials to give workable concrete with a fixed cement content, there should be developed by this group some useful fundamentals about concrete. The wide use of concrete, the proportions of which are designed to fit the grading and other characteristics, indicates that the influence of different materials is quite noticeable and that some materials are better suited for concrete (asphaltic or portland) than others. If these engineers could choose according to their preference there would be discrimination. Some materials are worth more than others. Will this fact be capitalized?

Barite in California

THE American Institute of Mining and Metallurgical Engineers, 29 West 39th street, New York City, has issued technical publication No. 266, entitled "Barite in California." It is from a paper prepared by Walter W. Bradley, San Francisco, state mineralogist of California.

Method of Comparing Subsieve Particle Distribution in Nonplastics

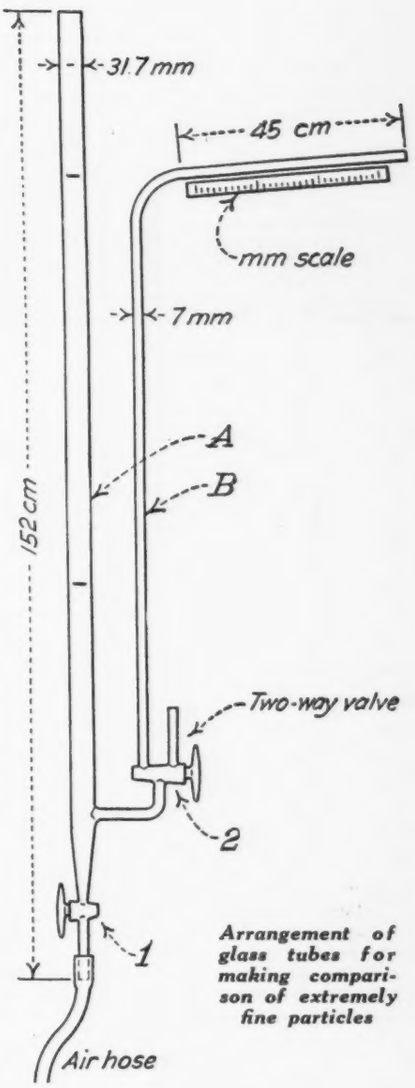
IN A PAPER presented by M. H. Hunt at the February, 1930, annual meeting of the American Ceramic Society at Toronto, Ont., a method is given for making a quick comparison of the size distribution or comparative fineness of such nonplastic materials as flint and feldspar as used in ceramics.

These materials are usually ground to such a fineness that screen tests are impractical as a means of determining the fineness, the percentage of residue left on a 325-mesh screen being no index of the percentage of extremely fine particles which have passed through the screen.

The apparatus used is an adaptation of the sedimentation method of Wiegner and consists of two glass tubes, one with a millimeter scale, and arranged so that a sample of the material in water may be agitated with air for a two-minute period and then allowed to settle over a 30- to 60-minute period, with readings of the water level in the second tube taken at intervals. The recession of the water in the second tube is a measure of the settling of the material in the main tube, and a curve drawn with the recession of water level as ordinate and time interval as abscissa indicates the relative amount of coarse and fine particles in the sample. A sample containing a large amount of coarse material will settle more rapidly than one with more fine material and consequently give a steeper curve.

This sedimentation method is of course not quantitative, but is intended as a simple and effective way of comparing samples, as, for instance, in the control of grinding operations.

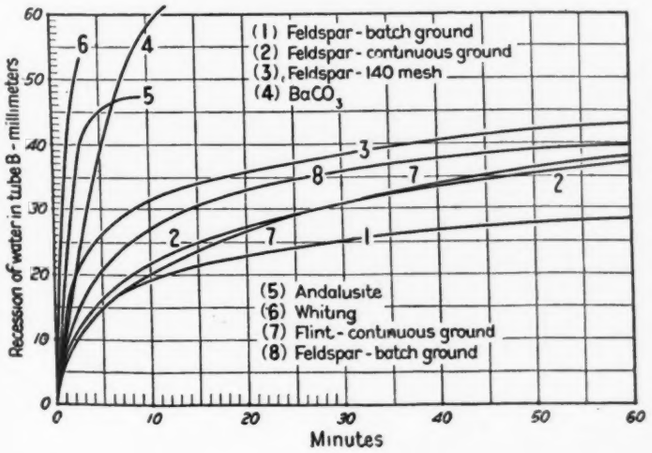
Curves were given for a number of samples of ground feldspar, flint, whiting, etc., along with corresponding screen analyses of these samples down to 325-mesh, and these indicated clearly that a small percentage of residue left on 325-mesh was not necessarily a measure of the percentage of extremely fine material.



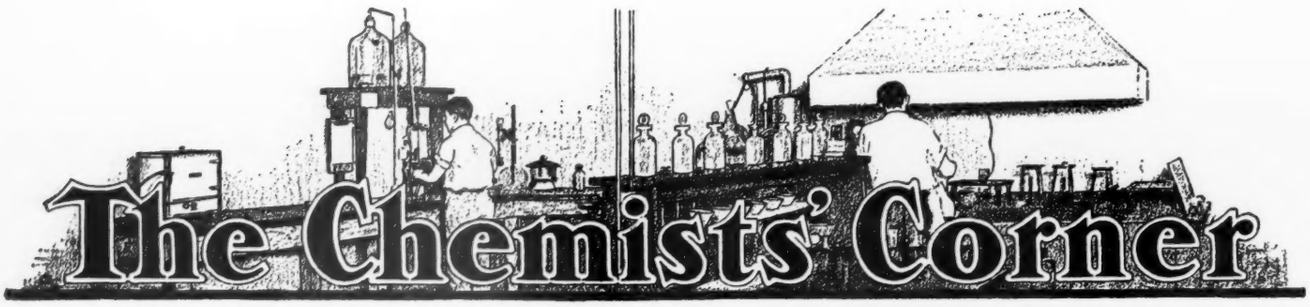
Arrangement of glass tubes for making comparison of extremely fine particles

SCREEN ANALYSIS

Material % residue	Batch ground feldspar	Continuous ground feldspar	140-mesh feldspar	BaCO	Andalusite	Whiting	Continuous ground flint	Batch ground feldspar
65-mesh		0.21	0.20	0.32	3.10		0.37	
100-mesh	0.07	0.20	2.05	0.14	0.17	0.02	0.27	0.04
150-mesh	0.19	0.70	5.95	0.14	10.70	0.04	0.57	0.15
200-mesh	0.60	1.40	4.65	0.10	7.70	0.07	1.19	0.75
260-mesh	1.67	2.20	7.57	0.12	6.82	0.15	2.42	3.80
325-mesh	2.59	4.10	6.75	0.12	6.52	0.35	4.15	10.27
	5.12	8.81	27.17	0.94	41.94	0.63	8.97	15.01
Number on curve	1	2	3	4	5	6	7	8



At left, chart comparing subsieve particle distribution



Rapid Determination of Magnesia in Portland Cement and Raw Materials

By Arthur J. Pool

Chief Chemist, Peninsular Plant, Consolidated Cement Corp., Cement City, Mich.

THE DETERMINATION of magnesia in cement and raw materials is usually made during the course of complete analysis after removal of silica, iron and alumina and lime by precipitating the magnesium as magnesium ammonium phosphate from an ammoniacal solution with diammonium phosphate. The $MgNH_4PO_4$ is ignited to magnesium pyrophosphate, $Mg_2P_2O_7$, from the weight of which the percentage of magnesia in the sample is calculated.

This method is susceptible to certain errors which are likely to cause inaccuracies in the results obtained, but when properly carried out it leaves little to be desired so far as accuracy is concerned. The chief objection to the method is the length of time required to complete the determination. By starting the analysis in the morning the results for magnesia cannot ordinarily be obtained sooner than the following morning, most of the time being taken up in evaporating and baking to remove silica, and to allow the precipitate of $MgNH_4PO_4$ to form. In the cement laboratory it is desirable, especially in control work, to obtain the magnesia content as quickly as possible. Under this circumstance the ordinary method may be too slow.

The object of this article is to describe a method for determining magnesia in cement and raw materials in about one-fourth the usual time, and with an accuracy sufficient for control purposes.

Method of Determination

Weigh out 0.5000 g. of the cement (Note 1) into a 250-ml. beaker. Add a little cold water, swirl to prevent lumping and add 10 ml. of dilute (1:1) hydrochloric acid. Digest on hotplate until solution is complete, dilute to about 125 ml. with hot water, bring to a boil and five or six drops of concentrated nitric acid, boil for a minute or two and precipitate iron and aluminum by adding a slight but distinct excess of ammonium hydroxide. Continue the boiling until odor of ammonia is faint, filter and wash with hot water, catching filtrate and washings in a 600-ml. beaker.

Invert funnel over original beaker and wash out the precipitate into the beaker with a jet of hot water from wash-bottle. Place the beaker containing the precipitate under the funnel and dissolve any precipitate adhering to the paper by pouring through the paper a small amount of hot dilute hydrochloric acid. Wash paper thoroughly to remove acid. Heat the solution to boiling and add just enough hydrochloric acid to dissolve the precipitate.

Reprecipitate the iron and aluminum by adding a slight but distinct excess of ammonium hydroxide, boil until odor of ammonia is faint, filter and wash thoroughly with hot water, catching the filtrate and washings in the same beaker containing the filtrate from the first precipitation. Discard the precipitate. Make the filtrate slightly acid with hydrochloric acid, heat to boiling and precipitate the lime as calcium oxalate by adding 30 ml. of hot ammonium oxalate (4% solution) and just enough ammonium hydroxide to make the solution ammoniacal, but avoid a large excess. Boil for a minute or two, allow to stand for 15 min., filter and wash six times on the filter with hot water, allowing each washing to run through before adding another (Note 2).

If desired, the lime may be determined at this point in the following manner: Fill the beaker in which the lime precipitation was made one-third full of cold water. Add 10 ml. of concentrated sulphuric acid, heat to about 90 deg. C., drop in the paper containing the calcium oxalate precipitate and while stirring vigorously titrate to a faint pink color with 0.1 *N* potassium permanganate. To the filtrate from the lime add a few drops of phenolphthalein indicator (1%, alcoholic solution) and enough sodium hydroxide (20% solution) to give a distinctly pink color. Boil, and as the color fades, add more sodium hydroxide.

Continue the boiling and addition of sodium hydroxide until it is evident that all ammonium salts have been decomposed and all ammonia has been expelled (Note 3). To the hot solution add with stirring just enough dilute hydrochloric acid to destroy pink color. Boil a minute or two and if color reappears add sufficient 0.4 *N* hydrochloric acid from burette to again destroy the color. Repeat until pink color does not reappear after boiling two or three minutes. Add dropwise from burette 0.4 *N* sodium hydroxide until one drop or less causes a *very* faint pink color. Now run in from burette exactly 10 ml. (Note 4) of the 0.4 *N* sodium hydroxide. Boil two or three minutes, allow precipitate to settle, filter and wash paper and precipitate thoroughly with hot water, catching filtrate and washings in a 600-ml. beaker. Titrate excess sodium hydroxide with 0.4 *N* hydrochloric acid until one drop or less causes the pink color to just disappear.

Boil the solution for a minute or two and if pink color reappears titrate again until one drop or less of the acid causes the pink color to barely disappear. Repeat until pink color does not reappear after boiling two or three minutes. The difference between the volume of 0.4 *N* sodium hydroxide added and the excess of sodium hydroxide found by titrating with 0.4 *N* hydrochloric acid is the volume of 0.4 *N* sodium hydroxide required to precipitate the magnesium. From the volume of 0.4 *N* sodium hydroxide required to precipitate the magnesium the percentage of MgO or $MgCO_3$ in the sample is calcu-

lated.

1 ml. 0.4 *N* NaOH = 0.0081 g. MgO
1 ml. 0.4 *N* NaOH = 0.0169 g. $MgCO_3$

Example:

Weight of sample taken = 0.5000 g.
Vol. 0.4 *N* NaOH added = 10.00 ml.
Vol. 0.4 *N* HCl required to neutralize excess NaOH = 7.95 ml.
Vol. 0.4 *N* NaOH required to precipitate Mg = 2.05 ml.

Then,

$2.05 \times 0.0081 \times 200 = 3.32\%$ MgO in sample

or,

$2.05 \times 0.0169 \times 200 = 6.93\%$ $MgCO_3$ in sample.

Notes

1. If sample is limestone, clay, shale or raw mix, first fuse the 0.5000-g. sample with the smallest possible amount of Na_2CO_3, dissolve the melt in dilute hydrochloric acid, avoiding large excess, then proceed as directed for cement.

2. Wash paper as well as precipitate. If CaO is to be determined by titrating with $KMnO_4$ all $(NH_4)_2C_2O_4$ must be washed out.

3. All ammonium salts must be decomposed and the liberated ammonia completely expelled. To determine if ammonia is still coming off, moisten end of a stirring rod with concentrated HCl and hold near the surface of the boiling solution. Dense white fumes indicate the presence of ammonia and the boiling must be continued until this test reacts negatively. The volume of the solution after removal of ammonia should not be greater than about 125 ml., and the solution should contain enough excess NaOH to give a distinctly pink color.

4. The 10 ml. of 0.4 *N* NaOH is sufficient for all portland cements. Dolomites or other materials containing large amounts of magnesium will require a larger amount of NaOH.

Accounting for Ignition Loss in Analysis of Clinker

(Reply to article by Alton J. Blank)

By Katsuzo Koyanagi
Chichibu Cement Co., Ltd., Tokyo, Japan

IN AN ARTICLE in the June 7, 1930, issue of Rock Products, Alton J. Blank points out the increase in loss of ignition as the origin of the decrease in the strength of the cements in my experiments, reported in Rock Products, May 10, 1930. He says that the increase in loss of ignition means: (1) Underburning of the cements, or (2) careless storage of the cement samples.

We say that neither explanation can be applied in our case. (1) We always burn our cement very hard. We take a sample of clinker every hour at the end of the cooler, and by classifying the quality of clinker control the burning process. It is a great disgrace for our burners to obtain underburned clinker in their kilns, which can easily be distinguished by visual inspection. Especially the clinkers No. 4 and No. 5 of my experiment were burned so hard that we must, in grinding, give the clinker a preliminary crushing to obtain the required fineness of cement. (2) As I already reported, we got the samples of cement every hour at the outlet of the cement mills, and the mean sample of 24 hours was sealed up in a can. The cement was tested on the next day.

Increase in ignition loss of the cements in our experiments comes from the moisture which the clinker takes up from air during storage in the clinker building. The clinker moisture depends naturally upon the amount of atmospheric moisture. Our experiments began in February, when the atmospheric moisture amounts usually from 40 to 60%, measured with Lambrecht's Polymeter, and lasted until June, which is rainy season in Japan, and the moisture in air amounts to 80 to 100%. From my experience, such small increases in loss of ignition as 0.45% (difference between Cement No. 1 and No. 5) doesn't affect the strength of the cement so much as Mr. Blank fears. This can be seen also from the results of the following experiment: We got three samples of cement, stored two months in hemp bags in the laboratory room. The cements were tested for ignition loss and strengths before and after storage. Table 1 shows the results of this testing.

We can see from this experiment, that after storage of two months, the loss on ignition increases very much in all cements, while the strengths do not decrease.

Mr. Blank points out kindly the errors in calculation of the lime ratio in my article, but this is also unnecessary, except the lime ratio of cement No. 5, which is misprint from the original paper and is 2.16, because we calculate in Japan as in Germany the hydraulic modulus of cement as follows:

$$\text{H.M.} = \frac{\text{Total lime—lime in gypsum added}}{SiO_2 + R_2O_3}$$

With regard to the sulphur content of the pyrite cinder: The value which I gave in the analysis is total sulphur, which is present as sulphide and sulphate. The content of sulphuric acid anhydride in the cinder is 0.95% SO_3. So the sulphur which is present as sulphide amounts to 1.18% S.

With the high content of iron oxide in the pyrite cinder, quite a small quantity of it (about 1% cinder on the weight of raw meal) was enough to increase the iron oxide content of cement from 2.79% to 3.48%. When the sulphur content of the added pyrite cinder is calculated on the weight of raw mixture it amounts to only 0.01% S. Besides, we carry out the analysis of the kiln gas very often and seldom find a reducing atmosphere in our kilns.

Table 2 shows the results of the gas analysis of our kilns.

It is impossible to think that such a small quantity of sulphur affects the strength and soundness so much as shown in my experiment.

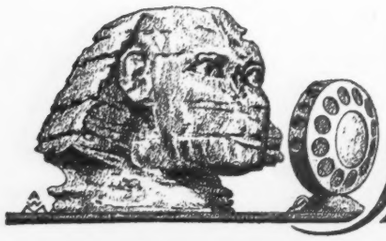
Mr. Blank says in the conclusion that his experience with sulphur containing raw materials has come to the end that poor combination of the materials is had in the kiln together with low kiln outputs, high fuel consumption, resulting in a finished product having low strengths, a tendency towards unsoundness and usually a discoloration. We are anxious to know the results of this experience more in detail, especially the sulphur content of the raw mixture.

TABLE 1. EFFECT OF STORAGE AND IGNITION LOSS ON STRENGTHS OF CEMENT

	Ignition loss and strengths of cements	Cement No. 1	2	3
Fresh cement	Ignition loss, percent	1.28%	0.85%	1.15%
	Tensile strength (1:3) kg./cm.²			
	7 days	36.3	44.0	34.5
	28 days	37.0	45.5	40.8
	Compressive strength (1:3) kg./cm.²			
	7 days	515.3	541.3	473.3
	28 days	599.0	634.0	567.6
After 2 months' storage	Ignition loss, percent	2.10%	1.90%	1.82%
	Tensile strength (1:3) kg./cm.²			
	7 days	35.5	43.6	33.3
	28 days	40.1	44.3	40.8
	Compressive strength (1:3) kg./cm.²			
	7 days	514.3	566.0	478.6
	28 days	629.0	631.0	616.3

TABLE 2. ANALYSES OF FLUE GAS OF KILNS

	1	2	3	4	5
CO_2 volume, percent	26.6	23.6	24.2	25.4	25.7
O_2	0.1	1.6	0.3	0.2	0.7
CO	0	0	0.1	0	0



Hints and Helps for Superintendents

Suspended platform in bin over batchers overcomes tendency of fines to segregate from coarser material

Segregation of Aggregate

THE PROBLEM of segregation of aggregates in loading is no simple one, nor is there apt to be a complete solution of this vexing problem where large sized aggregate is combined with smaller sizes, but there are numerous devices, some very simple and some complicated, involving considerable investment and no small amount of mechanical construction in their make-up, that help to overcome the tendency of the fines to segregate from the coarser material.

At the central concrete-mixing plant of the Woodstock Slag Corp., Birmingham, Ala., A. W. Smith, superintendent of the concrete department, was bothered with this condition in a bin that rests directly over the batchers. The bin is filled by an inclined belt conveyor from the slag-crushing plant. He corrected the trouble of segregation simply by suspending from four ¾-in. steel cables a platform about 2 ft. square and about 2 ft. below the top of the bin, so that when the crushed slag fell into the bin its fall was broken. The bin is filled intermittently, and as a rule is nearly full, and drawing out enough aggregate for one batch into the concrete mixer below leaves the bin in about the condition shown in the view herewith.

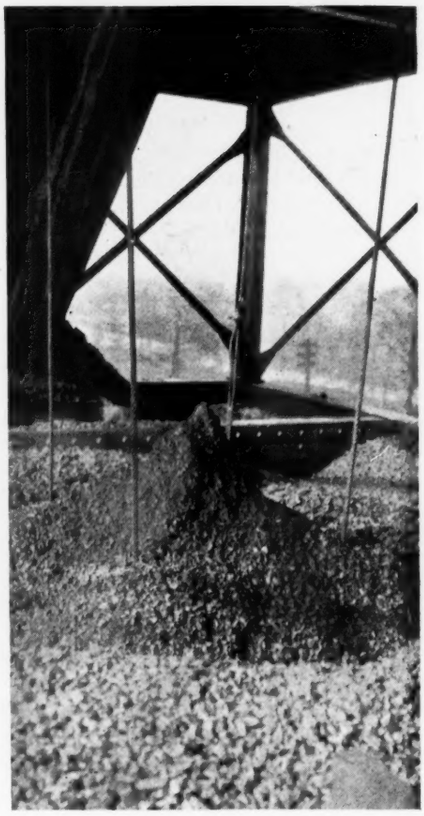
An attendant is kept on top of the bins to see that they are kept full of the different sizes of slag aggregate, sand, etc., and this operator from time to time gives the central pile of fines "a kick" to prevent any large accumulation of material there.

Retarder Indicator

AN alcoholic solution of phenolphthalein will show the presence or absence of retarder in gypsum plaster. By simply placing a drop of the indicator on the plaster, a resulting pink color will show that the plaster contains retarder.

Explain This One

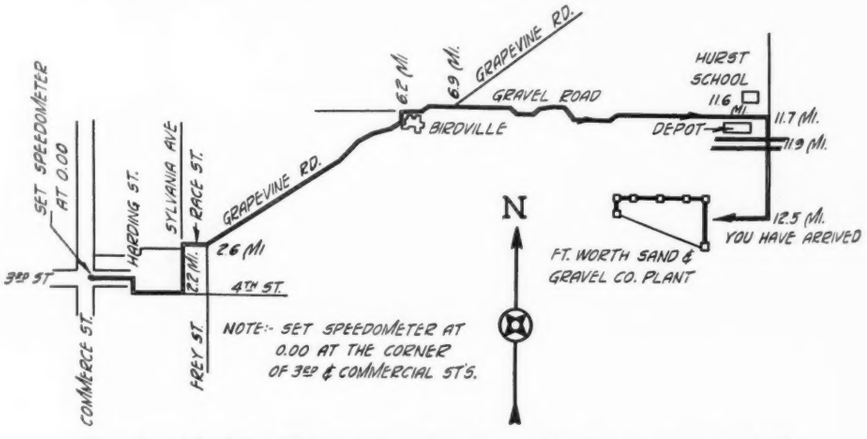
AT the Ludwig plant of the Standard Gyspum Co., each day for several weeks a 5-in. belt running on a flanged pulley would crawl up on the flange and then flip over putting a half twist in the belt, without stopping or interfering with the operation. When the belt had amused itself in that way for a while, it would flip back to its original position.



Giving the platform a "kick"

Plant Location Often a Problem

VERY OFTEN A PLANT OWNER is called upon to direct a truck driver or visitor to his plant, often at a needless waste of both parties' time. Not so with the Ft. Worth Sand and Gravel Co. The officials simply hand the questioner a map similar to the one shown and a lot of needless explaining is eliminated. The map shows in detail how to get to the plant near Ft. Worth, Texas.



Map furnished by officials of sand and gravel plant to visitors which facilitates directing

Hints for Running Steam Shovels

WHEN lowering the bucket for a cut, do not drop it so heavily as to lift the boom. Do not allow the bucket to swing back against the bottom frame, or the bucket and latch gear may be damaged.

Do not take too thick a cut, but regulate it so as to get a full bucket at the finish of an even cut right through.

Thrusting the bucket with the idea of quick filling only wastes time, as the engines frequently stall, and the machine is unnecessarily stressed.

Keep the floor reasonably level. It makes the machine easier to drive, quicker in operation and there is less wear and tear on the swinging gears.

Never begin to swing while the bucket is in the material; and if the bucket is dropped while swinging back, ready for the next cut, see that it does not strike the ground, the bottom framing or any obstructions, before the swing motion comes to rest.

When travelling—or moving up to the face—which is necessary when the material gets out of reach, first move the engine slowly round until the clutch engages. Then take the strain steadily, opening the regulator valve slowly until sufficient power to propel the machine is obtained.

Never jump at the travelling with a quickly opened regulator valve.

Never run with slack bearings. Keep them adjusted and take out any knock as soon as it appears, especially connecting rod bearings.

Do not adjust bearings too tightly, or they will run hot. If there is a tendency to do so and the cap is slacked back a little, tighten the bottom nut back against the lock nut. Don't look on the top nut as unnecessary. It is there for an important purpose. Keep the nuts locked tight.

Oil frequently and when grease cups are used, screw down until grease begins to ooze out of the bearings. Once a day is not sufficient. Use every opportunity to give the grease cups a slight turn.

Never use blunt teeth. Replace them. Blunt teeth mean ineffective digging, decreased output, and increased fuel consumption.

Use broad chisel points for cutting clay and similar material. Use sharp diamond points for breaking harder materials. For soft wet clay a cutting plate bolted on in place of the teeth is often better.

Manganese points are not suitable for sandy and abrasive materials. It is more economical to use mild steel teeth which can be relaid and drawn out, or a special cast steel point.

When the bushings in the bucket wear, they should be renewed before they are worn through.

Frequently examine and lubricate the boom head pulleys, which are often neglected.

Watch the gauge glass. Never let the water in the boiler get low enough to disappear from the glass. The boiler is fitted with both feed pump and injector. Regulate the feed pump at such a speed that it maintains the water feed at an even rate; and only use the injector in case of necessity. The pump and injector pipes are fitted with strainers inside the water tank. These should be periodically cleaned out by disconnecting the suction pipes, and thoroughly cleaning out both strainers and pipes.

The water tank should also be cleaned out periodically. Any dirt or foreign matter in the tank will choke the strainers of pump and injector suction pipes.

The length of life of a boiler depends to a large extent on the way it is used. Washing out should receive special attention because of the bad water frequently used. Neglect of this is a frequent cause of cracked firebox plates and leaking. If sediment is allowed to accumulate in the bottom of the boiler it soon rises above the fire level and causes the firebox plate to become overheated.

To prevent the deposit as far as possible the boiler should be blown down at least once a day. That is to say, the boiler should be well filled, and the blow off cock, at the back of the boiler, opened until the water level has dropped 2 in.

Washing out should be done once a week, if possible, all mud lids being taken out for this purpose and the deposit swilled out with a hose. The joint gaskets can be used over and over again if they are well coated with black lead.

Leaks in the boiler should be immediately attended to, and caulked, if necessary.

All steam joints on the boiler and in the piping should be kept tight. Attend to any leakage immediately.

Apart from the technical details of the boiler, correct firing is the most important factor in maintaining steam.

As a first principle, to maintain steam for continuous work at high pressure, use good coal.

The coal should be broken up into reasonably small pieces, and spread evenly over the firebars.

Keep a bright even fire about 4 in. to 6 in. thick.

Do not fire heavily, and never allow any part of the bars to be uncovered.

Keep the firebars free from clinker by raking the fire frequently with the hook which is provided.

During convenient intervals, remove ashes and clinker from the firebox.

Regulate the draft by means of the damper at the back of the boiler. Close it when not using the machine, and no steam is required. If necessary, drop the chimney damper, also.

To get more air space and greater draft for better steaming, remove one or two firebars, and respace the remaining bars.

Never open the fire hole door to reduce steam, and as far as possible avoid firing when the excavator is digging because of the increased draught due to the engine's exhausting into the chimney.

The cold air entering the fire hole and fire box will cause sudden contraction and lead to leaky joints.

At night, or whenever the machine is not required for several hours, close both ash pit and chimney dampers to prevent steaming; and bank the fire with small coal.

Close the main stop valves from the boiler.

Make a habit, summer and winter, of draining the water from all engine cylinders, pipes, and all steam and water connections, as far as possible.

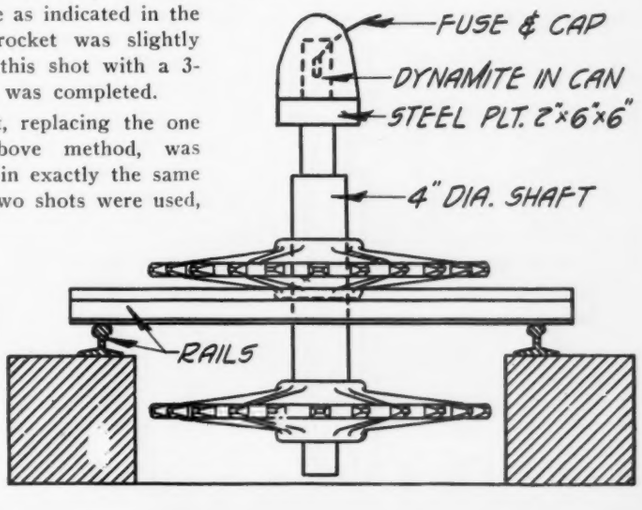
In summer it may not be necessary, but in winter, it is imperatively necessary, to prevent breakages due to frost—*From Ruston and Hornsby's (English) Instruction Book.*

Where a Press Could Not Be Had

By C. O. Granger
Robbins-Young Co., New London, Minn.

AFTER using a 35-ton whiskey jack on a 4-in. dragline shaft, when trying to remove a cat sprocket from the shaft, and having no success, we used 1½-sticks of dynamite as indicated in the drawing and the sprocket was slightly loosened. Following this shot with a 3-stick charge, the job was completed.

The chain sprocket, replacing the one removed by the above method, was pressed on the shaft in exactly the same manner except that two shots were used, one stick per shot.



Drawing indicates how dynamite was used for loosening cat sprocket from the shaft

Editorial Comment

Discrimination Vs. Standardization

Elsewhere in this issue is a very interesting, very instructive article by Stanley M. Hands on "Promotion of Premium Aggregates." The author should be well known to ROCK PRODUCTS' readers—and probably is—because he has sandwiched into his long experience as a highway engineer several years as an aggregate producer and salesman. He has practiced what he preaches; and he profited by it as a producer and salesman. Hence, his opinions demand respect.

While he praises organized industry as one of the means of accomplishing the end he seems to have in view, he does not appear to appreciate that in the same breath he is sowing the seeds of discord and disintegration in the industries as now organized. The keystone of present organizations in the rock products industry is standardization, at least in so far as standardization is possible. Standardization is the antithesis of discrimination, which the author recommends.

If discrimination is to be aided and promoted by the producer, it means selling one's product by comparison with one's competitor's product, on the merits one's product has over the competitor's. Under such conditions, producers recognize full well the enormous difficulties of co-operating with each other for any common end—even though that end is greater profit to those who can qualify.

Nevertheless, the industry is faced with the fact that there are vast differences in the concrete-making properties of various cements and various aggregates. The maker of concrete is fast learning of these differences, and in many instances is attempting to make his specifications accordingly. The problem presented is a very serious, and a very touchy one, obviously.

Portland cement manufacturers, for example, as a group or organization, insist that the only salvation of the industry is a universally accepted standard specification. As individual producers they are not in many cases adverse to capitalizing the particular virtues of their own product, by not complimentary comparisons with competitors' products. There is little question that as individuals they have materially contributed to or encouraged the making of individualistic (freak) specifications, which as a group, they are practically unanimous in condemning. The same is doubtless true of aggregate producers—and is entirely human and understandable.

All this, however, does not make for a healthful condition of the concrete industry. Off-hand anyone would say that quality of product should win over all other considerations; and that the producer who is capable of producing a quality product and intelligent enough to capitalize his knowledge of its quality—and that necessarily means a knowledge of the shortcomings of his competitors' product—should profit accordingly. But the line between selling on quality through odious comparisons, and openly selling by "knocking," which all agree is poor policy and an unfair trade practice, is a very difficult one to draw; and who is going to draw that line? We would say let the user take the initiative, as he is doing now.

The organized industry can not *prevent*—if it wanted to—individuals in that industry from making a quality product and capitalizing and selling their individual product on its merits in comparison with their competitors' products. In times of surplus capacity or of limited demand, some aggressive individuals always do this thing as a necessity to survival rather than take the alternative of price-cutting; but they usually recognize that it is not desirable as a general practice; and it is just as serious and as vital a problem to the welfare of the industry as indiscriminate price-cutting.

It is in such things as this that so-called codes of ethics or codes of trade practice fail miserably. Undoubtedly much could be done by a group of serious-minded men in frankly recognizing the issue, in meeting it openly and in agreeing upon a really constructive policy. But codes of business practice, especially those accepted and approved by the Federal Trade Commission, are of too general a nature to give any real help in meeting such a specific issue. The Cement Institute with its code (ROCK PRODUCTS, February 15, 1930) has attempted to meet this issue by pledging its members to sell cement guaranteed only to meet standard specifications; but so-called "freak" specifications continue to be made by cement users, and we have yet to hear of any producer refusing to make or sell cement to meet them.

So we cannot agree altogether with Mr. Hands in his argument for discrimination vs. standardization, for that is practically what it amounts to, as a policy for the rock products industry to adopt. It is probably true that it would make for the gain of some individuals, that it would put a premium on quality, knowledge, research and scientific salesmanship. We believe a premium should be placed on all these—but by the consumer. For we do not believe the industry should be disrupted by its own members in order to accomplish these things. As in all other attempts at perfection—in society, in government and in business—each individual must sacrifice some of his own personal welfare, profit or greed (take your choice) for the welfare of the whole, with which his own fortune is inseparably bound, in the long run. And the welfare of the whole is not going to be promoted by encouragement of too much discrimination by producers and salesmen between products that have so many various characteristics, none of which really, alone in itself, controls the quality of the finished product—concrete.

We do think that every producer should know his product well enough to know if it has or has not premium

value to the user, so that he as well as the user may profit by it. That is merely saving himself from being taken advantage of because of his ignorance of his own product. But we certainly do not endorse, at this stage of our industries, the idea of each and every producer going out to sell his product by telling how much better it is than some competitor's. Such methods, widely employed, would soon put the industry in a chaotic condition, from a *commercial* angle, however desirable it may be from a purely *scientific* angle. And either commercial and scientific consideration is as important to the success and welfare of the industry as the other.

Annual Harvest Festival of Roche Harbor Lime and Cement Co.

SUNRISE EXCURSIONS to see the lifting of fish-traps and banquets of suckling pig and barbecued salmon were highlights in the annual harvest festival of the Roche Harbor Lime and Cement Co., Seattle, Wash., as announced by John S. McMillin, president.

The three-day festival at Roche Harbor began Saturday, August 9, with a suckling pig banquet at the Hotel De Haro. An old-fashioned dance followed. The following morning the fish-traps were visited. A ball game provided entertainment in the afternoon, preceding a salmon barbecue dinner at McCracken Point.

Speakers at the barbecue dinner, included William E. Humphrey of the federal trade commission; Congressman Lin H. Hadley; Dr. E. O. Holland, president of Washington State College, and Dr. Rufus B. von Kleinsmid, president of the University of Southern California.

The program for Monday, August 11, opened with a trip through the limestone quarries and lime plant, followed by a business session.—*Seattle* (Wash.) *Post-Intelligencer.*

United States Gypsum Co. to Build Steel Lath Plant at Warren, Ohio

LOCATION of the United States Gypsum Co. plant in Warren, Ohio, which was announced recently, will benefit the steel output of Youngstown by approximately 50,000 tons annually, H. S. Warwick, industrial development engineer of the Youngstown Sheet and Tube Co., said.

Confirmation of the report that Warren had been selected as the site of the new plant of the Gypsum company was received by Mr. Warwick in a telephone conversation with officials of the company. The Warren Chamber of Commerce new industry committee learned officially that Warren had been selected in competition with several other cities.

The company plans to consume 20,000 tons of steel and to employ 100 to 125 men the first year, Mr. Warwick was told. Eventually the plant will require 50,000 tons of steel each year and will employ 400 to 500 men, he said.

The Gypsum company recently purchased the metal lath department of the Youngstown Pressed Steel Co. and operations were continued in a temporary plant in Youngstown.

The Gypsum company plans to expand the plant to include numerous items of steel building materials and the plant, when at capacity, would employ about 400 men, it is said. Steel to be fabricated would be purchased in the valley.—*Youngstown* (Ohio) *Telegram.*

St. Paul, Minn., Dealers Protest Cement Sales to City Direct

HEATED DISCUSSION marked debate in the St. Paul, Minn., city council over question of the city buying its own cement.

Argument followed submission of a letter in which six building material dealers protested against the proposal, originally broached to the council by Commissioner Clyde R. May. Result of the skirmish came in naming of Commissioners May, Milton Rosen and John H. McDonald as a committee to study the question of the city buying all of its building materials.

Signers of the protest were Capital City Lime and Cement Co., Corning-Donohue, Inc., F. J. Morse & Co., C. Speakes, St. Paul Builders' Material Co. and the Twin City Brick Co.

First comment came from Mr. Rosen who pointed out that if the city were to go into the cement business it would involve the purchase of a fleet of trucks for transport and therefore be an expensive proposition. Commissioner May then suggested a committee.

Mr. McDonald then jumped into the fray, arguing that the general idea had been studied several times previously without producing any tangible results.

"We will deprive these material dealers of their business, but you will find we won't save any money," he declared, and Mr. Rosen urged the matter be dropped.

"No, we won't drop it," countered Commissioner May. "We're interested in the welfare of the taxpayers and not just a small group of cement dealers. The state saved $250,000 by buying cement in 1929."

"Then why not go into business on a big scale and buy our crushed rock and other materials too?" Mr. Rosen asked.

"A great idea," answered Mr. May. "I am for it. We have a crushed rock plant already operating on city property out W. 7th St. and there is no reason why the city shouldn't take that plant over and get the benefits from it."

A motion to name the committee succeeded, four to two.—*St. Paul* (Minn.) *News.*

Deny Promotion of New Cement Mill in Oregon

REPORTS originating from Dr. Eueidas K. Scott, a director of the Wallowa Lime and Cement Co. of Oregon, to the effect that that company was planning a $3,000,000 cement plant in Portland were denied recently by I. L. Webster, Portland, secretary-treasurer of the company, and A. S. Kerry, Seattle, director, large individual holder and president of the Olympic Hotel Co., Seattle, Wash.

"I have no knowledge of any such plans as announced by Dr. Scott," Mr. Kerry declared. "Although I didn't attend the recent company meeting in Portland, I know of no such move being contemplated by our concern. The Wallowa Lime and Cement Co. was formed merely for the purpose of combining holdings of individual owners of marble deposits in Wallowa county, Oregon."

I. L. Webster, secretary-treasurer, said:

"We are nothing more than an eastern Oregon concern owning Marble mountain in Wallowa county and do not contemplate any venture such as that reported," Mr. Webster declared. "Somebody with good intentions got out a false report."

Officers of the undertaking announced were Lewis H. Mills of the Tidewater Timber Co., president; Walter J. Burns, Balfour-Guthrie Co., vice-president; I. L. Webster, insurance man, secretary-treasurer. The directors other than the above were A. S. Kerry, president of the Olympic Hotel Co., Dr. Eueidas Scott and R. Green.

Plans as announced were to quarry the marble in the company's Wallowa county holding and ship it to Portland.—*Seattle* (Wash.) *Journal of Commerce.*

Wire Reinforcement Institute

THE manufacturers of welded wire fabric reinforcement announce the establishment of the Wire Reinforcement Institute with headquarters in the National Press Building, Washington, D. C.

The purpose of the institute is to provide a centralized organization to exploit the technical and utilitarian merits of wire as used for concrete reinforcement. The activities of the institute will be conducted under the direction of Royall D. Bradbury, formerly instructor in structural design at the Massachusetts Institute of Technology; later, vice-president in charge of the welded fabric department of the Clinton Wire Cloth Co., and recently contract manager of the Aberthaw Construction Co. of Boston.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[29]	8- 8-30	96	.....	
Alpha P. C. new com.[2]	8- 8-30	24	25	50c qu. July 25
Alpha P. C. pfd.[2]	8- 8-30	118	.....	1.75 qu. Mar. 15
American Aggregates com.[29]	8- 8-30	19	24	75c qu. Mar. 1
Am. Aggr. 6's, bonds (W.W.)	8- 8-30	85	86	
American Brick Co., sand-lime brick	6-27-30	.....	5	25c qu. Feb. 1
American Brick Co. pfd.	7-28-30	60	65	50c qu. May 1
Am. L. & S. 1st 7's[29]	8- 8-30	95	.....	
American Silica Corp. 6½'s[49]	8-13-30	No market		
Arundel Corp. new com.	8- 8-30	43	.....	75c qu. July 1
Atlantic Gyp. Prod. (1st 6's & 10 sh. com.)[10]	8-13-30	40	50	
Beaver P. C. 1st 7's[29]	8- 8-30	95	99	
Bessemer L. & C. Class A[4]	8- 8-30	29	32	75c qu. Aug. 1
Bessemer L. & C. 1st 6½'s[4]	8- 8-30	91	94	
Bloomington Limestone 6's[29]	8- 8-30	74	78	
Boston S. & G. new com.[47]	8- 8-30	17	20	40c qu. Apr. 1
Boston S. G. new 7% pfd.[47]	8- 8-30	46	50	87½c qu. Apr. 1
California Art Tile A	8- 9-30	.....	8	43¾c qu. Mar. 31
California Art Tile B	7-24-30	.....	3	20c qu. Mar. 31
Calaveras Cement com.	8- 8-30	.....	14	
Calaveras Cement 7% pfd.	8- 8-30	.....	87	1.75 qu. July 15
Canada Cement com.	8-10-30	.....	15	
Canada Cement pfd.	8-10-30	95	96	1.62½ qu. June 30
Canada Cement 5½'s[48]	8- 8-30	99¾	100½	
Canada Cr. St. Corp. bonds[48]	8- 8-30	95½	.....	
Certain-teed Prod. com.	8-13-30	6	7	
Certain-teed Prod. pfd.	8-10-30	30	37	1.75 qu. Jan. 1
Cleveland Quarries	8-11-30	60	.....	75c qu. 25c ex. Sept. 1
Columbia S. & G. pfd.	8-11-30	89	94	
Consol. Cement 1st 6½'s, A	8-13-30	80	90	
Consol. Cement 6½% notes	8-13-30	70	75	
Consol. Cement pfd.[29]	8- 8-30	50	60	
Consol. Oka S. & G. 6½'s[12] (Canada)	8- 8-30	99	101	
Consol. Rock Prod. com.[44]	8- 8-30	1¾	2¼	
Consol. Rock Prod. pfd.[44]	8- 8-30	9¾	10½	43¾c qu. June 1
Consol. Rock Prod. units	8- 9-30	21	24	
Consol. S. & G. pfd. (Can.)	8-10-30	.....	85	1.75 qu. Aug. 15
Construction Mat. com.	7-30-30	16	.....	
Construction Mat. pfd.	7-28-30	40¼	41	87½c qu. Aug. 1
Consumers Rock & Gravel, 1st Mtg. 6's, 1948[18]	8- 7-30	90	95	
Coosa P. C. 1st 6's[29]	8- 8-30	50	54	
Coplay Cem. Mfg. 1st 6's[40]	8- 8-30	95	.....	
Coplay Cem. Mfg. com.[40]	8- 8-30	10	.....	
Coplay Cem. Mfg. pfd.[40]	8- 8-30	60	.....	
Dewey P. C. 6's (1942)[30]	8-13-30	98	.....	
Dewey P. C. 6's (1930)[30]	8-13-30	98	.....	
Dewey P. C. 6's (1931-41)[30]	8-13-30	98	.....	
Dolese & Shepard	8-12-30	78	82	$2 qu. July 1
Dufferin Pav. & Cr. Stone com.	8-10-30	.....	18	
Dufferin Pav. & Cr. Stone pfd.	8-10-30	83½	85	1.75 qu. July 2
Edison P. C. com.[29]	6-28-30	10	.....	
Edison P. C. pfd.[29]	6-28-30	25	.....	
Giant P. C. com.[2]	8- 8-30	5	15	
Giant P. C. pfd.[2]	8- 8-30	15	25	1.75 s.-a. June 16
Gyp. Lime & Alabastine, Ltd.	8-10-30	19	19½	37½c qu. July 2
Hermitage Cement com.[11]	8- 8-30	30	40	
Hermitage Cement pfd.[11]	8- 8-30	86	90	
Ideal Cement, new com.[33]	8- 9-30	50	52	75c qu. July 1
Ideal Cement 5's, 1943	8-11-30	101	.....	
Indiana Limestone units[29]	8- 8-30	.....	90	
Indiana Limestone 6's	8-11-30	77	.....	
International Cem. com.	8-13-30	64	65	$1 qu. June 27
International Cem. bonds 5's	8-11-30	101¼	.....	Semi-ann. int.
Iron City S. & G. bonds 6's[46]	7-25-30	.....	91	
Kelley Is. L. & T. new st'k	8-11-30	36¼	40	62½c qu. July 1
Ky. Cons. St. com. V. T. C.[48]	8- 7-30	9	10	
Ky. Cons. Stone 6½'s[48]	8- 7-30	94	98	
Ky. Cons. Stone pfd.[48]	8- 7-30	88	92	1.75 qu. Aug. 1
Ky. Cons. Stone com.[48]	8- 7-30	9	10	
Ky. Rock Asphalt com.[11]	8- 8-30	13	15	40c qu. July 1
Ky. Rock Asphalt pfd.[11]	8- 8-30	85	90	1.75 qu. Mar. 1
Ky. Rock Asphalt 6½'s[11]	8- 8-30	90	100	
Lawrence P. C.	8- 8-30	59	64	$1 qu. June 28
Lawrence P. C. 5½'s, 1942	8- 8-30	85½	.....	
Lehigh P. C.	8-11-30	32	32	62½c qu. Aug. 1
Lehigh P. C. pfd.	8-11-30	103½	105	1¾% qu. July 1
Louisville Cement	8-10-30	250	.....	
Lyman-Richey 1st 6's, 1932[13]	8- 8-30	97	99	
Lyman-Richey 1st 6's, 1935[13]	8- 8-30	97	99	
Marblehead Lime 6's[14]	8- 8-30	90	95	
Marbelite Corp. com. (cement products)	8- 8-30	200	.....	
Marbelite Corp. pfd.	8- 8-30	12	.....	50c qu. July 10
Material Service Corp.	8-13-30	16⅞	19½	50c qu. Sept. 1
McCrady-Rogers 7% pfd.[32]	8- 7-30	50	.....	
McCrady-Rogers com.[22]	8-7 -30	20	20½	
Medusa Portland Cement	8-11-30	.....	95	1.50 July 1
Mich. L. & C. com.[6]	8- 8-30	23	.....	
Missouri P. C.	8-13-30	29⅜	.....	50c qu. Aug. 1
Monolith Portland Midwest	8- 9-30	2	4	
Monolith bonds, 6's[9]	7-24-30	80	85	
Monolith P. C. com.[9]	8- 7-30	4	5	40c s.-a. Jan. 1
Monolith P. C. pfd.	8- 9-30	4½	6	40c s.-a. Jan. 1
Monolith P. C. units[9]	8- 7-30	12	15	
National Cem. (Can.) 1st 7's[43]	8- 8-30	99½	100½	
National Gypsum A com.	8-12-30	5¾	6½	
National Gypsum pfd.	8-11-30	29	30	
Nazareth Cement com.[26]	7-14-30	22	.....	
Nazareth Cement pfd.[26]	7-14-30	100	.....	
Newaygo P. C. 1st 6½'s[29]	8- 8-30	100½	.....	
New Eng. Lime 1st 6's[14]	8- 8-30	90	95	
N. Y. Trap Rock 1st 6's	8-12-30	100	.....	
N. Y. Trap Rock 7% pfd.[38]	8- 8-30	95	.....	1.75 qu. Apr. 1
North Amer. Cem. 1st 6½'s	8-13-30	59	.....	
North Amer. Cem. com.[29]	8- 8-30	4¼	5½	
North Amer. Cem. 7% pfd.[29]	8- 8-30	21	26	
North Shore Mat. 1st 5's[15]	8-13-30	95	.....	
Northwestern States P. C.[37]	8-11-30	110	120	$2 Apr. 1
Ohio River Sand com.	7-28-30	15	17	
Ohio River Sand 7% pfd.	7-28-30	97	99	
Ohio River S. & G. 6's[16]	8- 8-30	85	90	
Oregon P. C. com.[9]	8- 8-30	9	.....	
Oregon P. C. pfd.[9]	8- 8-30	89	90	
Pacific Coast Aggregates com.	8- 9-30	4	.....	
Pacific Coast Cement 6's[5]	8- 7-30	75	77	
Pacific P. C. com.	8- 8-30	15	19	
Pacific P. C., new pfd.	8- 7-30	65	75	1.62½ qu. July 5
Pacific P. C. 6's	8- 8-30	99½	.....	
Peerless Cement com.[21]	8- 8-30	7½	8	
Peerless Cement pfd.[21]	8- 8-30	80	85	1.75 Apr. 1
Penn.-Dixie Cement pfd.	8- 6-30	40	48	
Penn.-Dixie Cement com.	8-13-30	6⅛	7¾	
Penn.-Dixie Cement 6's	8- 8-30	82½	.....	
Penn. Glass Sand Corp. 6's	7- 9-30	102	104	
Penn. Glass Sand pfd.	7- 9-30	110	.....	1.75 qu. July 1
Petoskey P. C.	8-11-30	9	9½	15c qu. Apr. 1
Port Stockton Cem. units[9]	2-17-30	.....	30	
Port Stockton Cem. com.[9]	8- 8-30	No market		
Riverside Cement com.	8- 8-30	11⅜	14⅝	
Riverside Cement pfd.	8- 9-30	74	.....	1.50 qu. Aug. 1
Riverside Cement, A	7-15-30	12	14	31¼c qu. Aug. 1
Riverside Cement, B	8- 9-30	2	.....	
Roquemore Gravel 6½'s[17]	8- 8-30	99	100	
Santa Cruz P. C. 1st 6's, 1945[5]	8- 7-30	105½	.....	6% annually
Santa Cruz P. C. com.	8- 7-30	90	.....	$1 qu. July 1
Schumacher Wallboard com.	8- 9-30	10⅛	.....	
Schumacher Wallboard pfd.	8- 8-30	20	21¾	50c qu. Aug. 15
Southwestern P. C. units[44]	7-24-30	240	.....	
Standard Paving & Mat. (Can.) com.	8-10-30	18	20	50c qu. May 15
Standard Paving & Mat. pfd.	8-10-30	87	90	1.75 qu. Feb. 15
Superior P. C., A	8- 8-30	35	37	27½c mo. Aug. 1
Superior P. C., B	8- 9-30	12	.....	25c qu. Mar. 20
Trinity P. C. units[37]	8-11-30	130	140	
Trinity P. C. com.[37]	8-11-30	30	40	
Trinity P. C. pfd.[29]	8- 8-30	110	120	
U. S. Gypsum com.	8-11-30	42	43	40c qu. Sept. 30
U. S. Gypsum pfd.	8-11-30	120	125	1.75 qu. Sept. 30
Universal G. & L. com.[3]	8-13-30	No market		
Universal G. & L. pfd.[3]	8-13-30	No market		
Universal G. & L., V. T. C.[3]	8-13-30	No market		
Universal G. & L. 1st 6's[3]	8-13-30	No market		
Warner Co. com.[16]	8- 8-30	39¼	40	50c qu. & 25c ex. July 15
Warner Co. 1st 7% pfd.[16]	8- 8-30	100	103	1.75 qu. July 1
Warner Co. 1st 6's	7-29-30	98	99	
Whitehall Cem. Mfg. com.[36]	8- 8-30	80	.....	
Whitehall Cem. Mfg. pfd.[36]	8- 8-30	50	.....	
Wisconsin L. & C. 1st 6's[15]	8-13-30	95	.....	
Wolverine P. C. com.	8- 7-30	4¼	4¾	15c qu. May 15
Yosemite P. C., A com.	8- 9-30	2	3	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett. New York. [3]Rogers, Tracy Co., Chicago. [4]Butler Beadling & Co., Youngstown, Ohio. [5]Smith, Camp & Co., San Francisco, Calif. [6]Frederic H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago. Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central Trust Co. of Illinois. [16]J. S. Wilson, Jr., Co., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simon & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [24]A. B. Leach & Co., Inc., Chicago, Ill. [25]Richards & Co., Philadelphia, Penn. [26]Hincks Bros. & Co., Bridgeport, Conn. [28]Bank of Republic, Chicago, Ill. [29]National City Co., Chicago, Ill. [30]Chicago Trust Co., Chicago. Ill. [33]Boettcher Newton & Co., Denver, Colo. [36]Hanson and Hanson, New York. [37]S. F. Holzinger & Co., Milwaukee, Wis. [39]Tobey and Kirk, New York. [40]Steiner, Rouse and Stroock, New York. [43]Jones, Heward & Co., Montreal, Que. [44]Tenney, Williams & Co., Los Angeles, Calif. [46]Stein Bros. & Boyce, Baltimore, Md. [47]Wise, Hobbs & Arnold, Boston. [48]E. W. Hays & Co., Louisville, Ky. [49]Blythe Witter & Co., Chicago, Ill.

INACTIVE ROCK PRODUCTS SECURITIES (Latest Available Quotations)

Stock	Price bid	Price asked	Stock	Price bid	Price asked
Holliston Trap Rock Co. com.[2] 67 sh., per sh.	35	.....	Universal Gypsum and Lime, 200 shs.[3]	$2 for the lot	.....
Universal Gypsum and Lime, 300 shs.[3]	$4 for the lot	.....	Consolidated Cem. com. v.t.c., 3220 shs.[1]	1½ per share	.....

[1]Price at auction by Wise, Hobbs & Anold, Boston, Dec. 18, 1929. [2]Price at auction by R. L. Day & Co., Boston, July 16, 1930. [3]Price at auction by Adrian H. Muller & Son, New York, Aug. 6, 1930.

Certain-Teed Products Corp. Earnings Statement

THE Certain-Teed Products Corp., New York City, manufacturer of numerous building material products, and one of the three or four largest producers of gypsum products, reports for six months ended June 30, 1930, net loss of $756,938 after depreciation, depletion, interest, federal taxes, etc., comparing with net loss of $665,478 in the first half of 1929.

Net loss for quarter ended June 30 was $206,374, after above charges, comparing with net loss of $550,564 in preceding quarter and net loss of $81,904 in June quarter of previous year.

Consolidated income account for six months ended June 30, 1930, compares as follows:

	1930	1929	1928
Gross profits after depreciation and depletion	$1,863,171	$1,943,201	$2,251,956
Other income	51,923	16,046	70,717
Total income	$1,915,094	$1,959,247	$2,322,673
Cost expenses and bank interest	2,301,632	2,232,544	2,050,510
Bond interest	355,265	374,558	220,770
Federal taxes	11,706	22,200	13,330
Sundry adjustments (debit)	3,429	†4,577	†2,504
Net loss	$ 756,938	$ 665,478	*$40,567

*Net income. †Credit.

Consolidated balance sheet of the Certain-Teed Products Corp. and subsidiaries as of June 30, 1930, compares as follows:

ASSETS

	1930	1929	1928
*Land, buildings, machinery and equipment	$19,873,512	$20,890,509	$21,819,211
†Water power rights	644,857	648,320	651,784
‡Gypsum deposits	3,569,479	3,578,361	4,495,242
Timber lands	903,753	903,753	.....
Goodwill, trademarks, etc.	1	1	1
Cash	1,619,709	1,358,007	2,113,234
Notes receivable	377,544	279,590	361,257
Accounts receivable	3,462,014	5,402,925	5,234,794
Miscellaneous accounts receivable	57,105	88,366	118,370
Advertising and sundry accounts	31,572	35,257	35,854
Inventories	4,795,542	5,668,677	7,026,480
Advance to trustees	815,867	575,000	.....
Preferred stock redemption deposit	.....	.....	177,910
Cash for sinking fund	.....	165,759	.....
Investment in and advertising to subscribers	530,157	609,077	606,436
Other investments	232,965	210,287	413,651
Prepaid expenses	547,683	429,128	376,814
Total	$37,461,160	$40,842,947	$43,431,038

LIABILITIES

7% preferred stock	$ 6,302,430	$ 6,302,430	$ 6,290,390
§Common stock	17,370,000	17,370,000	17,370,000
Old first and second preferred stock not redeemable	.....	.....	177,910
Debenture bonds	12,900,500	13,532,500	13,762,500
Notes payable	.....	700,000	.....
Accounts payable	646,737	1,170,271	1,380,695
Dividends payable	.....	.....	508,502
Accrued local taxes	.....	.....	58,583
Accrued federal taxes	64,589	149,485	271,082
Accrued bond interest	235,841	247,321	251,708
Reserve for federal taxes	11,706	22,200	22,488
Miscellaneous reserves	.....	.....	70,859
Capital surplus	1,414,644	1,435,054	1,435,814
Deficit	1,485,687	118,114	¶1,711,867
Minority stock interest	400	31,800	118,700
Total	$37,461,160	$40,842,947	$43,431,038

*After depreciation. †After amortization. ‡After depletion. §Represented by 400,000 no-par shares. ¶Earned surplus.

United States Gypsum Co. Six Months' Earnings

THE UNITED STATES GYPSUM CO., Chicago, Ill., reports for the six months ended June 30 a 24% increase in net profits over the corresponding period of 1929.

The consolidated net income for the first half of 1930 was $2,891,750 after depreciation, depletion, federal taxes and all other charges, equivalent after preferred dividends to $2.24 a share earned on 1,170,472 shares of $20 par common stock outstanding at the end of the period. This compares with a net income of $2,329,244 in the corresponding period of 1929, or equivalent to $2.70 on 765,027 shares of common stock outstanding. The issued amount of common stock was increased principally through the sale of additional shares to stockholders.

All through 1929 the gypsum industry was faced with unfavorable conditions within the trade as well as declining building activity. Many of the smaller companies in the field faced with the problem of keeping plants operating despite the curtailed demand for their products entered into a price-cutting warfare, with the result that there was a general unsettlement in the gypsum field.

The United States Gypsum Co. kept from joining in this movement for some time, but finally was forced to meet the situation by reducing its prices; the result was the poor showing made in the first half of 1929, according to a statement by President Sewell L. Avery.

Although conditions have not been remedied entirely, some of the worst features have been eliminated and with a return of construction activity the gypsum industry should fare better.

The United States Gypsum Co. closed the first half of this year in an unusually strong financial position, with current assets of $16,550,813, of which nearly $7,000,000 was in cash and government securities, as against current liabilities of $1,621,617. Bank loans of $1,600,000 existing as of June 30, 1929, were liquidated during the last year.

Comparisons of the consolidated income account and balance sheet follow:

CONSOLIDATED INCOME ACCOUNT

Six months ended June 30—

	1930	1929
Net earnings	$ 4,343,104	$3,258,662
Depreciation and depletion	1,055,152	666,363
Federal taxes	396,201	263,056
Net income	2,891,750	2,329,244
Preferred dividends	269,210	264,503
Common dividends	928,709	610,566
Surplus for period	2,391,041	1,638,879
Previous surplus	30,684,764	27,193,274
Surplus at end of period (P&L)	33,075,806	28,832,153
*Earnings on common	$2.24	$2.70

*Based on 1,170,472 shares in 1930 and 765,027 shares in 1929.

CONSOLIDATED BALANCE SHEET

ASSETS

As of June 30—

	1930	1929
Plant and equipment	$58,359,301	$53,565,002
Stock subscription	1,630,044	3,000,388
Investments	276,299	208,127
Deferred charges	939,434	984,605
Current assets:		
Cash	943,156	684,206
Government securities	6,044,388	6,479,899
Receivables	5,027,796	4,753,763
Cons. cont. rec.	247,289	545,688
Inventories	4,288,184	3,081,737
Total current assets	$16,550,813	$15,545,294
Total assets	$77,755,890	$73,303,416

LIABILITIES

Preferred stock	$ 7,841,700	$7,541,700
Common stock outstanding	23,409,440	15,300,540
Common subscription	.....	7,603,680
Surplus	33,075,806	28,832,153
Reserves	11,807,327	10,008,747
Current liabilities:		
Notes payable	.....	1,600,000
Accounts payable	662,815	1,059,260
Accruals	958,802	1,357,335
Total current liabilities	$ 1,621,617	$ 4,016,596
Total liabilities	$77,755,890	$73,303,416

Commenting on the outlook, Sewell L. Avery, president of the company, in his letter to stockholders states:

"While indications point to a further decline in building, reasonably satisfactory earnings seem probable for the remainder of the year. The newly constructed gypsum plants recently placed in operation, while faced with restricted tonnage, are performing satisfactorily."

Recent Dividends Announced

Cleveland Quarries (ex.)	$0.25	Sept. 1
Cleveland Quarries (qu.)	0.75	Sept. 1
Consolidated Sand and Gravel, Ltd., pfd. (qu.)	1.75	Aug. 15
International Agricultural pfd. (qu.)	1.75	Sept. 2
Lehigh Portland Cement pfd. (qu.)	1.75	Oct. 1
Material Service (qu.)	0.50	Sept. 1
Schumacher Wallboard part. pfd. (qu.)	0.50	Aug. 15
Superior Portland Cement "A" (mo.)	0.27½	Sept. 1
United States Gypsum com. (qu.)	0.40	Sept. 30
United States Gypsum pfd. (qu.)	1.75	Sept. 30

Kentucky Consolidated Stone Co.

E. W. HAYS AND CO., Louisville, Ky., bankers for the Kentucky Consolidated Stone Co., Louisville, Ky., crushed-stone producer, have issued the following statement, dated August 6:

The Kentucky Consolidated Stone Co. began operations May 1, 1928. Originally the following securities were outstanding:

First mortgage 6½% bonds	$1,000,000
7% cumulative preferred stock	600,000
No-par common stock (shares)	100,000

To date the sinking fund of the company has retired $148,000 first mortgage 6% bonds and $64,500 of 7% preferred stock. The company must retire a minimum of $70,000 bonds and $30,000 of its preferred stock each year. The equity ownership of the common stock is thus materially increased each year by this operation.

The current position of the company as of July 1, 1930, is 3 to 1, with no bank loans and over $76,000 cash in bank.

Net earnings for the fiscal year ending April 30, 1930, were 53% ahead of the first year's net, amounting to $1.27 earned on the common stock after all charges. The net earnings for the first two months of this fiscal year were $47,907.84, after all charges, against $33,570.49 for the same period last year, or practically 48c a share on the common stock. The preferred dividend is being currently earned over 5 times.

Skagit Talc, Inc., to Offer Stock at 1c Par

PERMISSION to sell 4,900,000 shares of stock in Skagit Talc, Inc., was granted the company recently by the division of securities.

The company, with headquarters in Seattle, Wash., will sell the stock at 1 cent par per share.

Concrete Paving Ahead of 1929

TOTAL AWARDS for concrete pavements for this year in the United States passed the 100,000,000 sq. yd. mark August 2, according to Wm. M. Kinney, general manager of the Portland Cement Association. This mark was reached three weeks ahead of last year and the total was greater than that of any previous year. Mr. Kinney declares that this is in response to the urgent need for more motoring space and that it expresses confidence in American economic conditions.

Of the total awards 77,700,000 sq. yd. are for concrete roads and 23,000,000 sq. yd. for streets and alleys. August 2 of last year concrete road awards totaled 62,190,000 sq. yd. and in the record year of 1928, 62,400,000 sq. yd. The 1930 road total of this date is, therefore, over 15,000,000 sq. yd. ahead of last year and the record breaking year of 1928.

Why Illinois Is Largest Consumer of Agricultural Limestone

IT IS GENERALLY KNOWN that the farmers of Illinois have been buying close to 1,000,000 tons of agricultural limestone a year for several years past. Following is a sample of the kind of promotional literature which has been so effective in creating this demand. It is from a local weekly newspaper and reads:

DOLLAR FOR LIME BRINGS BACK $8 AN ACRE PROFIT

Every dollar spent for limestone will bring back a net yearly return of around $8 an acre, according to results of carefully conducted experiments made by the experiment station of the College of Agriculture, University of Illinois, in widely scattered parts of the state. Results of the experiments show that limestone profitably improves the fertility of most soils of the state. Limestone can be bought in any quantity for $1.80 to $2.50 a ton at most shipping points in Illinois.

The question often is asked, "Why is it that farmers do not use more lime?" The answers usually are the expense, lack of equipment for hauling and spreading or lack of time.

As far as the actual cost of the lime is concerned it is not as expensive as some of the more common farm operations. For example, it costs at least $2 an acre to plow a field. The cost of liming a field at the rate of 2½ tons an acre, including the lime, hauling and spreading, amounts to an average of $8.12 an acre. It looks rather expensive, but when it is considered that this lime application of 2½ tons an acre will put the land in condition to produce clover or alfalfa for 10 years or more without additional lime, the annual cost of liming is only 81 cents an acre as compared to $2 an acre for turning the ground with a plow.

Use of limestone and phosphate, where the test shows it is needed, is an important factor in the best success with alfalfa. This test will be demonstrated on Alfalfa Day to farmers of Macon county when the Wabash special demonstration train, with specialists from the College of Agriculture, makes an all-day stop at Harristown on August 4 for a complete demonstration and discussion of factors influencing success in growing alfalfa.

Arundel Corp. Six Months' Earnings

THE Arundel Corp. (sand and gravel), Baltimore, Md., reports for six months ended June 30, 1930, net income of $1,197,513 after depreciation and taxes, equivalent to $2.43 a share on 492,556 no-par shares of stock. This compares with $940,126, or $1.91 a share, on above number of shares in 1929.

Current assets as of June 30, last, amounted to $5,455,069 against current liabilities of $732,707.

Tennessee Phosphate Rock Industry Prospering

REPORTS from all branches of the phosphate rock mining industry in and about Mt. Pleasant, Tenn., indicate a healthy condition of quiet operating without undue activity, but with satisfactory withdrawals against contract requirements from all acidulators, both customers of independent miners and factories of fertilizer companies operating their own mines.

Producers of both ordinary rock phosphate and of lime phosphate are filling storage to capacity and report gradually increasing shipments for the active season about to begin.

It is significant to note that while 1929 was not exceptionally active from appearances or reports, the government figures show a production and sale of about 634,000 long tons, 20,000 tons more than the banner post-war year of 1920 and only 4,000 tons less than the all-time record year of 1907. In both the years 1907 and 1920 the apparent activity was enormous and prices soared out of all control. This shows the far more solid and dependable foundation on which the industry now stands and reflects the satisfactory progress under way among the producers for all consuming lines.—*The American Fertilizer.*

New Slag Plant for Ohio

THE STANDARD SLAG CO., Youngstown, Ohio, which for years has been taking the slag at the Trumbull Cliffs furnace, Warren, Ohio, has started the installation of a crusher and screening plant there so that the slag can be prepared for market instead of being shipped to the Youngstown plant.

The equipment will be rather extensive and will give employment to from 15 to 20 men when completed. It is expected that it will be ready for operation by September 1. —*Warren* (Ohio) *Tribune-Chronicle.*

Working Alberta Tar Sands

THE bituminous sands of the McMurray area, near the junction of the Athabaska and Clearwater rivers in northern Alberta, Canada, are yielding 5 bbl. of 99.5% pure vitumen, or 500 lb. to 5 bbl. of sand in experiments being conducted by the mines branch of the Ottawa Department of Mines. The hot-water process used is the discovery of Dr. K. A. Clark of the University of Alberta, who has been working on the problem for the past 10 years. The Department of Mines expects to extend its extracting operations this summer in the effort to ascertain the quantity of by-products obtainable. The commercial value of the extraction process depends largely on the success in obtaining gasoline and other products from the sands and whether the product can compete commercially with tar that is secured as a by-product from other sources

New Indiana Gravel Plant in Operation

D. A. DAVIS AND CO. of Crawfordsville, Ind., have secured a complete, modern gravel and sand washing plant located just off of West Wabash avenue, Crawfordsville.

The plant, in addition to washing and screening the gravel dipped from the deposit, also crushes the large rocks that pass the series of screens. The plant is of the most up-to-date term in every detail.

The bin of the plant holds more than 200 cu. yd. of material. The bin is 40 ft. tall, the tipple about 60 ft. high and the cableway excavator mast 90 ft. tall.

The material is taken from a trench which runs 90 ft. deep. It is carried to the top of the tipple and in a 1¼-yd. bucket, from which it falls into a hopper and is flumed out by water at the rate of 700 gal. a minute. The gravel first goes into a rotary scrubber and then over the screens.

The sand and roof gravel (pea gravel) are separated from the remainder of the material. The road and concrete gravel is screened out with the oversize material going into the boulder crusher.

All the sand and sediment goes to an automatic sand-settling tank, where the coarser sand settles and the fine sand and mud or silt goes to a spoil pile—*Crawfordsville* (Ind.) *Journal.*

New York State Crushed Stone Association Meeting

POSSIBLY because of the heat, but more likely due to various other reasons, the August 7 meeting of the New York State Crushed Stone Association at Syracuse was not as well attended as it should have been. Only 16 were present at the Hotel Syracuse when business was taken up, but the meeting was an interesting one because of the importance of the work at hand.

After the usual preliminary details, such as the acceptance of minutes of the previous meeting at Buffalo and reports of various committees, the members launched into a healthy discussion of a proposed bonding law for materials. It seems that Senator Fearon, chairman of the joint committee of the New York state legislature, will hold a hearing at Albany on or about August 20, and if sentiment for a state bonding law is as strong as it now appears, his committee will recommend the introduction of such a bill at the next legislative session.

A materials bonding law has been recommended by the New York State Crushed Stone Association for at least five or six years. It was believed then, and is still believed, that only through such a law will their interests be properly safeguarded. In the state of Pennsylvania a similar law in effect at present seems to be giving almost universal satisfaction.

At the end of the discussion a resolution was unanimously passed, as follows: "That the New York State Crushed Stone Association favors the early enactment of a bonding law covering materials on public contracts, and that a copy of the resolution be forthwith transmitted to Senator Fearon."

It was urged upon everyone present to recognize the necessity of attending the forthcoming legislative committee hearing at Albany and to see that all absentee members were advised of the date and circumstances. A. L. Hooker will look after Buffalo territory, A. J. Sickles is to handle the Rochester district, F. J. Owens will handle Syracuse, A. S. Owens will handle Utica, and B. R. Babcock will take care of Albany.

There were different ideas about the proper place for the proposed summer meeting, to which highway officials and others are to be invited. Some suggested Rochester, others a boat trip on Lake Ontario, and still others a meeting at the Thousand Islands. It was finally decided to leave it to the decision of the executive committee.

A short program of entertainment was offered by Messrs. Owens and Hickey of the General Crushed Stone Co., Syracuse, after which the meeting adjourned subject to the call of the chair.

Fire Damages Cleveland Plaster Mill

CITY AND STATE FIRE WARDENS investigated the cause of a $25,000 fire that on July 30 partially destroyed the plaster mill of the Cleveland Gypsum Co., 1800 Merwin avenue, Cleveland, Ohio, the firm that was awarded the contract to supply plaster for the interior decorating of the new county jail courts building.

Fears that the blaze might delay work on the new county building were dispelled early by County Commissioner J. H. Harris, chairman of the jail building committee, who said: "There will be no delay. We will use a similar grade of plaster from some other company."

Ten companies and two tugs, directed by Fire Chief Wallace, battled three hours to quell the blaze.

The blaze was discovered at 9:30 p. m. by Robert Barnes, 1226 Lakeland avenue, Lakewood, a watchman at an adjacent warehouse.

At the height of the blaze the second floor of the mill, where large quantities of plaster and other supplies were stored, buckled under the weight and a part of the roof collapsed.—*Cleveland* (Ohio) *News.*

Queer Gravel Plant Accident

AN EMPLOYE of the city of Denver, Colo., Dave Lawson, was riding on the running board of one of the city's trucks, out at a sand pit along the Platte river. The right-hind wheel struck a sharp pointed board causing it to fly upward and the sharp point penetrated Lawson's abdomen, his death coming a short time thereafter.

City Fathers Kick About Cement Contract

THE DISADVANTAGES under which the manufacturers of a popular commodity—portland cement—labor because of the dealings they have to have with public authorities—and politicians—is well illustrated in the case of the city of Tacoma, Wash., and its cement contract, which has received a large amount of local publicity. Such publicity among its customers is naturally not very favorable to the cement manufacturer, who is entirely within his rights; and, moreover, is doing the only businesslike thing he could do under the circumstances. For while contracts protecting the purchaser against a drop in price, and at the same time guaranteeing the price against a rise, have been written in the cement industry, they certainly are generally recognized as very unfair to the producer.

The following, from the *Tacoma News-Tribune,* tells the story:

"Because the market prices of cement are now lower than at the time of the framing of the city's cement contract with the Olympic Portland Cement Co., the city is not legally in any position to claim rebates or reduction in price in the cement furnished for the Cushman power project, it was ruled recently in the official report prepared by Wallace W. Mount, corporation counsel.

"The report, which will be taken up by the city council at its coming meeting, was asked by the council several weeks ago, after Mayor Melvin G. Tennent's release of a $50,000 accrued payment warrant to the George Scofield Co., which is acting as local agent of the Olympic Portland Cement Co. Coincident with the release, the mayor brought the charge that Tacoma was paying about 70c per bbl. more for the cement than the city of Seattle paid for the cement needed for the Skagit power project. He argued that the loss on the 126,000 bbl. of cement the city had contracted to purchase would amount to nearly $100,000 and asked that the corporation counsel make an investigation.

"The report just submitted states that the contract upon the city is binding and that no loopholes are left on which claim might be based for a reduction in price or a rebate. It was shown, however, that had the price of cement gone up instead of down that Tacoma would have been protected through its contract against having to pay under a higher rate."

Cement in Czechoslovakia

CZECHOSLOVAKIA ordinarily produces about 8,791,500 bbl. of cement annually but the figures for 1929 show a reduction due to the fact that plants did not operate at full capacity. The country exported 70,367 bbl. last year, mostly to the border districts of Germany and Austria. Imports amounted to 31,995 bbl. Prices average 90 c. per 100 kgm. as compared with $1.11 to $1.20 in Germany.

Foreign Abstracts and Patent Review

Multi-Chamber Mills With Air Separators. A. B. Helbig describes and illustrates several screening plants operating on the return-circuit air separating principle, also in combination with multi-chamber and ball mills. He covers a centrifugal air separator (Fig. 1), a pneumatic air separator (Fig. 2), a Pfeiffer mill consisting of air separator and ball mill (Fig. 3), a tube mill with air separator (Fig. 4), an air separator with intermediate bin (Fig. 5). The author renders also a calculation of the separating process and separating efficiency of a multi-chamber mill equipped with an air separator. He refers to the large Allis-Chalmers mill with air separator, and then states that Pfeiffer Bros. Co. built this form of intermediate separator years ago.—*Zement* (1930) **19**, 2, pp. 25-28.

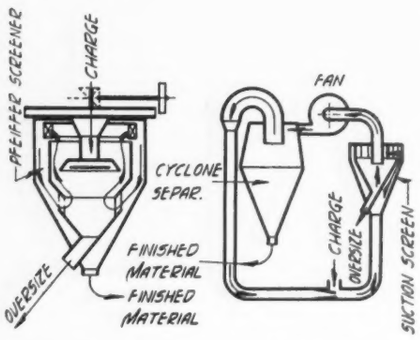


Fig. 1 **Fig. 2**

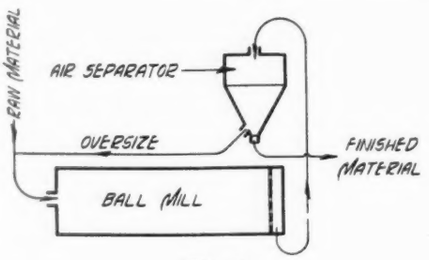


Fig. 4

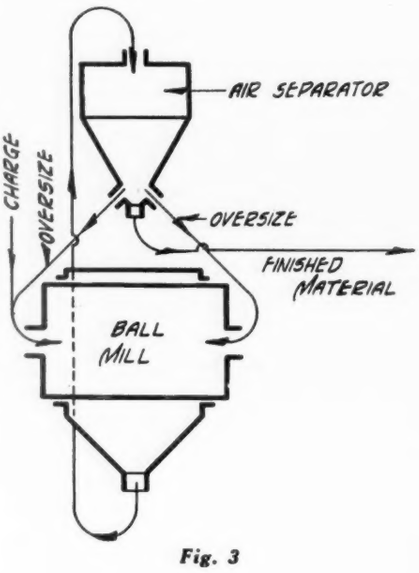


Fig. 3

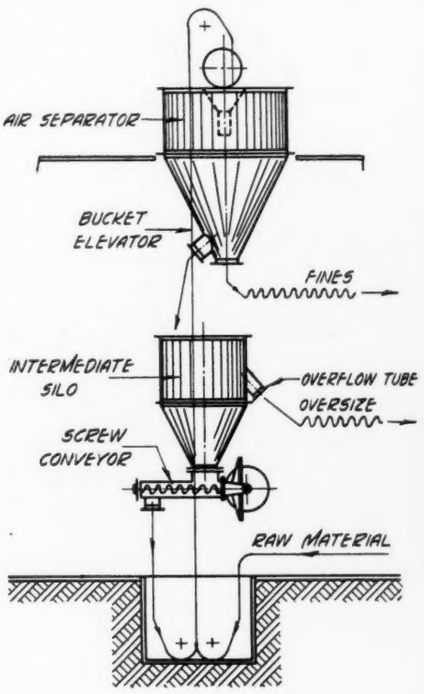


Fig. 5

White Cements. L. Nicol classifies white cements into white portland cements, white "marble" cements, white magnesia cements and white special cements of special composition. White portland cements include all those which chemically are similar in composition and in properties to the gray portland cement. In 1907 the portland cement plant Stern at Finkenwalde succeeded in manufacturing the first German white portland cement. There was a demand in 1903 and 1906 for a white portland cement, since the gray color of the ordinary portland cement often concealed the best colors which had been added, particularly the white and light-yellow colors. It was very difficult to obtain a pure color.

The manufacture of a pure good, white portland cement causes considerable difficulties and depends entirely upon the purity of the raw materials. These should have first of all as few iron compounds as possible; therefore limestones and clays must be used which are low in iron. These, however, are rarely found. The raw materials must be ground very fine and the heat of the burn must be raised to sintering.

The white portland cements examined by the author had on the average the following chemical composition: 51-52% lime, 13-24% silicic acid, 6-13% alumina, 0.2-0.6% ferric oxide, 0.4-1.5% sulphuric acid, 0.2-0.4% magnesia, 0.3-2.0% potash salt, 2.3-6.0% loss on ignition. In every white portland cement the ferric oxide was replaced by alumina down to a small part. The properties of the white portland cement are quite similar to those of the ordinary gray portland cement, except that the white cement sets slower, which is said to be due to the considerably higher degree of gel formation. From 10 to 25% of very fine white quartz sand should be added to the white cement when making the concrete, and the mixing water must contain no iron.

A plant at Stettin made a good white Stern cement of the following average composition: 58-60% lime, 19-20% silicic acid, 12-14% alumina, 0.3-0.6% ferric oxide, 1.0-1.5% sulphuric acid, 5-6% loss on ignition, 0.1-0.3% magnesia, 0.3-0.5% potash soda.

Of the foreign white cements the author considers the American Atlas cement entirely exceptional. It is available in Germany and is of very outstanding quality. It can well be used with German portland cements for a surface layer. Additions of good white lime proved to be quite successful. Repeated analyses give the following composition: 61-62% white lime, 22.5-26% silicic acid, 6.0-6.3% alumina, 0.2-0.5% ferric oxide, traces of magnesia, 0.5-2% potash-soda, 2.3-3% loss on ignition.

A very good white portland cement is also the American Medusa cement which has been imported into Germany since 1910. It has also great strengths and in its properties is similar to the American Atlas cement.

The French cement Lafarge is also well known for its beautiful white color. Its compressive strengths are lower than those of the American white cements, but it costs less. Another good French white cement is the Le Noble cement which has the following composition: 62.75% lime, 22.00% silicic acid, 5.90% alumina, 0.25% ferric oxide, 0.60% magnesia, 0.55% sulphuric acid, 0.20% alkalies, 9.15% loss on ignition.

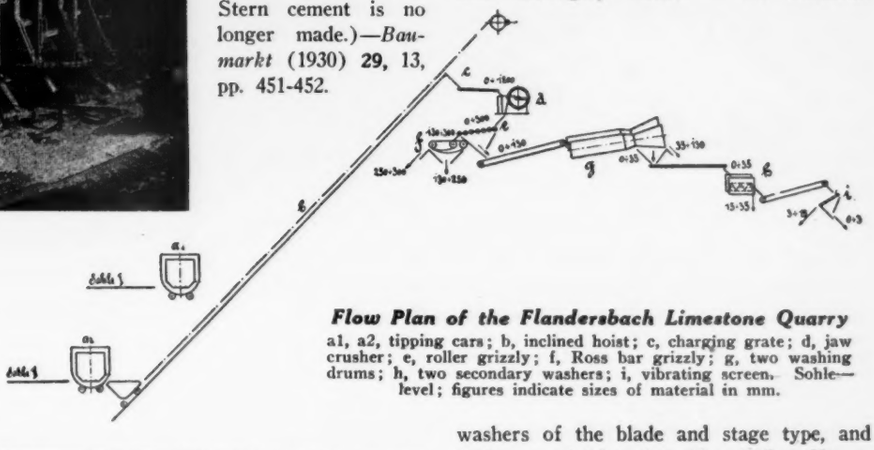
* * * *

"Marble" cements are in general not to be used for outside work, for they are not hydraulically hardening cements. It is a double-burned gypsum with additions of alum. MacLean is a good English "marble" cement. A Luxemburgian "marble" cement has the following composition: 67.80% lime, 20.20% silicic acid, 1.25% alumina, 0.25% ferric oxide, 1.38% magnesia, 1.26% carbonic acid, 1.30% sand, 6.04% loss on ignition,

Washing and screening plant in German quarry

0.40% sulphuric acid. Russia has a very light "marble" cement called La Glyptolithe. A Swiss white marble cement has the following composition: 5% loss on ignition, 39% lime, 18% silicic acid, 28% alumina and ferric oxide, 7% sulphuric acid, 1.2% alkalies, 0.6% magnesia, 0.2% baryte.

Of the white special cements, one is made from rock chalk, infusorial earth (kieselguhr) and soda solution; and the other from burned lime (white lime) and ground colorless silicic acid, which are mixed in the slaking drum. The author presents these data in the hope that the German cement plants will give more attention to the manufacture of these exceptional cements and that soon a German white portland cement can be used. (The Stern cement is no longer made.)—*Baumarkt* (1930) **29**, 13, pp. 451-452.



Flow Plan of the Flandersbach Limestone Quarry

a1, a2, tipping cars; b, inclined hoist; c, charging grate; d, jaw crusher; e, roller grizzly; f, Ross bar grizzly; g, two washing drums; h, two secondary washers; i, vibrating screen. Sohle—level; figures indicate sizes of material in mm.

View of the limestone treating plant

Modern German Limestone Quarrying Plant. P. Ludowigs describes the operating equipment of the Flandersbach limestone quarry of the Rhineland Limestone Works, Wuelfrath. This plant is of special interest to Europeans because of several American innovations. There are four electrically-operated 4½-cu. yd. shovels working on two levels and loading into side-dump cars of 25 tons capacity each. These are the first German-built electric shovels to be equipped with Ward-Leonard control. The cars are hoisted on an incline of 500-ton handling capacity per hour. The material is dumped on to a charging grate for even distribution, to be dropped into the jaw crusher of 400 to 500-ton capacity per hour. The crushed material is passed to a roller grizzly, the first installed in a European limestone quarry. The oversize of 130 mm. are passed on to a Ross rotating bar grizzly. All material below 130 mm. size is thoroughly washed in two scrubbers having grading cones, and each of 125 tons capacity per hour. The material below 35 mm. size is then thoroughly washed in two Excelsior washers of the blade and stage type, and further graded into 0 to 15 and 15 to 35 mm. sizes. The vibrator screen employed is as yet rarely found in German limestone plants. Rubber belt conveyors are employed in the plant. Operating power is purchased and amounts to 1900 kw. for all operations. —*Tonindustrie-Zeitung* (1930) **54**, 42, pp. 699-702.

Calculation of Heat Flow in Rotary Cement Kiln. A. B. Helbig learns from the technical press that the G. Polysius concern has succeeded in burning 100 kg. (or 220 lb.) of cement in a rotary kiln by using 100,000 kcal. (or 400,000 B.t.u.). A kiln 24 m. (or 79 ft.) in length and of 2.1-m. (or 6.9 ft.) diameter produced 100 metric tons of clinker in 24 hours. The raw material is granulated, dried and more or less decarbonated before it enters the kiln.

These results cause the author to determine whether the new kiln is more economical than the rotary kiln equipped to utilize the waste heat. By making an extensive calculation of the heat flow, he offers proof that the rotary kiln with utilization of waste heat is unconditionally superior to the Lejol kiln. *Zement* (1930) **19**, 19, pp. 440-444.

Traffic and Transportation

Car Loadings of Sand and Gravel, Stone and Limestone Flux

THE following are the weekly loadings of sand and gravel, crushed stone and limestone flux (by railroad districts) as reported by the Car Service Division, American Railway Association, Washington, D. C.:

CAR LOADINGS OF SAND, GRAVEL, STONE AND LIMESTONE FLUX

District	Limestone Flux Week ended July 12	Limestone Flux Week ended July 19	Sand, Stone and Gravel Week ended July 12	Sand, Stone and Gravel Week ended July 19
Eastern	3,386	3,370	13,137	13,406
Allegheny	3,243	3,370	9,224	9,760
Pocahontas	670	600	1,601	2,068
Southern	532	469	8,049	8,546
Northwestern	794	1,476	8,857	9,921
Central Western	395	416	12,283	12,871
Southwestern	406	521	8,319	8,680
Total	9,426	10,222	61,470	65,252

COMPARATIVE TOTAL LOADINGS, BY DISTRICTS, 1929 AND 1930

District	Limestone Flux 1929 Period to date July 20	Limestone Flux 1930 Period to date July 19	Sand, Stone and Gravel 1929 Period to date July 20	Sand, Stone and Gravel 1930 Period to date July 19
Eastern	91,080	80,120	247,198	192,211
Allegheny	97,786	76,519	165,923	156,866
Pocahontas	10,597	12,363	22,551	31,193
Southern	14,712	18,795	240,397	212,665
Northwestern	28,857	26,200	141,383	122,527
Central Western	14,751	13,261	259,962	261,770
Southwestern	12,925	12,335	171,689	176,318
Total	270,708	239,593	1,249,103	1,153,550

COMPARATIVE TOTAL LOADINGS, 1929 AND 1930

	1929	1930
Limestone flux	*270,708*	*239,593*
Sand, stone, gravel	*1,249,103*	*1,153,550*

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week of August 9:

CENTRAL FREIGHT ASSOCIATION DOCKET

25669. To establish on **cement, common, hydraulic, natural or portland,** carloads, minimum weight 50,000 lb., marked capacity of car to govern, if less, from Superior, O. (Rates in cents per 100 lb.):

To	Pres. rate	Prop. rate
Penna. R. R.		
Jeffersonville, Ind.	14	14½*
New Albany, Ind.	14	14½*
Louisville, Ky.	14	15 *
C. I. & L. Ry.		
Pekin, Ind.	14½	15½†
Borden, Ind.	14½	15½†
Broom Hill, Ind.	14½	15½†
Carwood, Ind.	14½	15½†
Wilsons, Ind.	14½	15½†
Bennettsville, Ind.	14½	15½†
St. Joseph, Ind.	14½	15½†
Smiths, Ind.	14½	15½†
New Albany, Ind.	14	14½‡
Louisville, Ky.	14	15 ‡

*Route D. T. & I., Ironton; N. & W., Cincinnati; B. & O. destinations.

†Route D. T. & I., Ironton; B. & O., Mitchell; C. I. & L. destinations.

‡Route D. T. & I., Ironton; N. & W., Cincinnati; B. & O. destinations.

25673. To establish on **crushed stone,** carloads (See Note 3), from Greenfield, O., to Gallipolis, O., rate of 100c per net ton. Present rate, 110c per net ton.

25675. To establish on **rock, gypsum, crushed** (not ground), **or run of mine,** carloads, minimum weight 100,000 lb., from Gypsum, O., to Bay Bridge, O., rate of 40c per net ton. Present, 70c per net ton.

25687. To establish on **sand and gravel,** carloads (See Note 3), from Earlville and Hugo, O. (located on P. R. R.), to points in Ohio rates as illustrated below. (In cents per net ton):

From Earlville, O.

To—	Prop. rate	Pres. rate	To—	Prop. rate	Pres. rate
Bedford	....	60	Summitville	85	90
Beloit	70	80	Salineville	85	90
Niles	75	90	Rome	90	100
Lordstown	....	80	Millersburg	95	100
North Jackson	....	80	Loudonville	100	110
Champion	....	80	Crestline	115	120

From Hugo, O.

To—	Prop. rate	To—	Prop. rate
Bedford	65	Summitville	85
Beloit	70	Salineville	85
Niles	75	Rome	90
Lordstown	80	Millersburg	95
North Jackson	80	Loudonville	100
Champion	80	Crestline	115

25688. To establish on **slag, commercial, crushed,** carloads, in bulk in open top equipment, and **slag, other than commercial, crushed,** carloads (See Note 3), from Bellaire, O., to points in West Virginia, as shown below:

To—	Prop. rate*	Pres. rate*
Spencer	195	225
Ripley	190	205

*Rates in cents per net ton.

25692. To establish on **crushed stone,** carloads (See Note 3), from Calcite, Mich. (near Rogers City), (rates in cents per ton of 2000 lb.):

To	Present	Proposed
Milwaukee, Wis.	550	202

Proposed rates will be made to apply via Bay City, G. T. Ry. or P. M. Ry.

25694. To cancel present rates on **lime, common, hydrated, quick or slacked,** carloads, as published in N. & W. Ry. Tariff G. F. 179B, from Kenova, W. Va., to points in West Virginia, as shown below (rates in cents per 100 lbs.):

To	Pres. rate	To	Pres. rate
Blue Creek	12½	Gilmer	18½
Bower	18	Milliken	12½
Braxton	18	Otter	16
Clay Court House	15	Pinch	12½
Clendennin	13	Porters	13½
Copen	18	Shelton	14
Dundon	15	Strange Creek	16½
Exchange	18	Two Mile	12½
Falling Rock	13	Villa Nova	16½
Frametown	17½	West Sutton	18
Gassaway	17½		

Classification basis to apply in lieu thereof.

25696. To establish on **sand, viz., lake, river and bank,** other than sand loam, carloads, from Gary, Calumet and Willow Creek, Ind., to Pontiac, Mich., rate of 139c per net ton. Route—Via Wabash Ry., Detroit, Mich., Grand Trunk Ry. Present—22½c.

25697. To establish on **lime, agricultural,** carloads, minimum weight 30,000 lb., from Carey, O. (Rates in cents per 100 lb.):

To	Pres.	Prop.
North Randall, O.	11	8
Solon, O.	11	8
Geauga Lake, O.	11	8
Aurora, O.	11	8
Mantua, O.	11	8
Jeddoe, O.	11	8
Garrettsville-Hiram, O.	11	8

25711. To establish on **sand-lime brick,** carloads, minimum weight 60,000 lb., from Jackson, Mich., to—

Antwerp, O.	Maumee, O.
Auburn, O.	Napoleon, O.
Archbold, O.	Ney, O.
Butler, Ind.	Paulding, O.
Cavett, O.	Pettisville, O.
Cecil, O.	Scott, O.
Defiance, O.	Sherwood, O.
Haviland, O.	Stryker, O.
Holland, O.	Waterloo, Ind.
Jewell, O.	Wauseon, O.
Latty, O.	Woodburn, Ind.

Rate of 170c per ton of 2000 lb.. Present—Classification basis.

25748. To establish on **sand and gravel,** carloads (See Note 3), from Randles, O., to Belles Valley, O., rate of 90c per ton of 2000 lb. Present rate, 95c per ton of 2000 lb.

25749. To establish on **sand and gravel,** carloads (See Note 3), from Massillon, O., to Beloit and Kensington, O., rate of 75c per ton of 2000 lb. Present rate, 80c per ton of 2000 lb.

25756. To establish on **masonry cement,** in mixed carloads with **cement, hydraulic, natural, common or portland,** minimum weight 50,000 lb., except when for carriers' convenience cars of less capacity are furnished, in which case minimum weight will be marked capacity of car furnished, but in no case less than 40,000 lb., from West Winfield, Penn., to points in Central Freight Association territory and points east of the Western Termini or Eastern Trunk Lines, same rates as at present published in Pennsylvania Tariffs I. C. C. 152 and I. C. C. F-2001 on cement, common, hydraulic, natural or portland, carloads. Present rate, classification basis.

25765. To establish on **sand and gravel,** carloads (See Note 3), from Lafayette, Ind., to Kankakee, Ill., rate of 75c per net ton. Present rate, 76c per net ton.

25766. To establish on **drain tile,** carloads, minimum weight 30,000 lb., from Haviland, O., to Milwaukee, Wis., rate of 16c. Present rate, 23c.

25767. To establish on **sand-lime brick,** carloads, minimum weight 60,000 lb., from Sebewaing, Mich., to St. Ignace, Mich., rate of 315c per net ton. Route—Via Saginaw and Michigan Central R. R. Present rate, 340c per net ton.

25768. To establish on **sand-lime brick,** carloads, minimum weight 60,000 lb., from Sebewaing, Mich., to Cass City, rate of 105c and to Deford and Kingston, Mich., rate of 120c per net ton, these rates to apply in connection with the P. M. Ry. and G. T. Ry., via Pigeon, Mich. Present rate, 150c to Cass City, 175c to Deford and 190c per net ton to Kingston, per P. M. Tariff 5817-G, I. C. C. 4690.

25770. To establish on **crushed stone,** carloads (See Note 3), from Cold Springs, O., to South Charleston, O., rate of 70c per net ton. Present rate, 80c per net ton per C. C. C. & St. L. Ry. Tariff No. 1906-B.

25771. To establish on **crushed stone,** carloads (See Note 3), from Osgood, Ind., to Pierceville and Milan, Ind., rate of 50c per net ton. Present rate, 59c per net ton.

25772. To establish on **slag,** carloads (See Note 3), from Ashland, Ky., to Dayton, O., rate of 160c per ton of 2000 lb. Present rate, classification basis.

25774. To establish on **crushed stone,** carloads (See Note 3), from Wapakoneta, O. (rates in cents per net ton):

To	Prop.	Pres.
Alger, O.	70	10½
McGuffey, O.	70	11½
Kenton, O.	80	11½

25775. (a) To establish on **stone, lake or river filling (offal of quarry),** in carloads, all cars to be loaded to cubical or visible capacity, from Kipton, O. (rates in cents per net ton):

To	Prop.	Pres.
Ashtabula Harbor, O.	88	13½
Cleveland, O.	76	11½
Erie, Penn.	126	17½
Lorain, O.	76	9½

Present rates, sixth class. (b) To establish on **stone, rip rap, rubble and quarry scrap,** carloads (See Note 3), from Kipton, O., to Erie, Penn., rate of 7½c. Present rate, 10c per 100 lb.

25778. To establish on **stone, crushed, coated with oil, tar or asphaltum,** carloads (See Note 3), from Jamestown, N. Y.

To	*Prop.	Pres.
Sherman, N. Y.	107	11½
Panama, N. Y.	107	11½
Clymer, N. Y.	119	11½
Waterford, Penn.	130	13
Erie, Penn.	142	13½
Spartansburg, Penn.	119	13
Centreville, Penn.	130	13
Tyronville, Penn.	130	13
Hydetown, Penn.	130	13
Tidioute, Penn.	142	13½
Warren, Penn.	142	13½
Kinzua, Penn.	142	13½
Sugar Run, Penn.	142	14
Corydon, Penn.	142	14
Onoville, N. Y.	153	14½
Kane, Penn.	153	15½
Ridgway, Penn.	176	17½
Emporium, Penn.	188	17½

*Proposed rates in cents per ton of 2000 lb.

25780. To establish on **drain tile,** carloads, minimum weight 30,000 lb., from Haviland, O., to Covington, Ind., 14c; Crawfordsville, Ind., 13c; Danville, Ill., 14c; Lafayette, Ind., 12½c; Leb-

anon, Ind., 13c; New Ross, Ind., 13c; Swannington, Ind., 13½c; Veedersburg, Ind., 14c; proposed rates. Route— C. N.-Ansonia-C. C. C. & St. L. Ry. Present rates, sixth class.

25786. To establish on **sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding or silica) and **gravel**, carloads (See Note 3), from Wolcottville and Winona Lake, Ind., to Winterman, O., rate of 105c per net ton. Route—Via P. R. R., Fort Wayne, Ind., N. Y. C. & St. L. R. R., Fort Wayne, Ind., N. Y., C. & St. L. R. R. Present, classification basis.

25789. To establish on **crude slag** (product of iron furnaces) (not crushed, ground or pulverized), carloads (See Note 1), from Weirton, W. Va., to Mingot Junction, O., rate of 40c per ton of 2000 lb. Present rate and minimum weight, 45c per ton of 2000 lb. (See Note 2), per Penna. R. R. Tariff I. C. C. 183.

25790. To establish on **stone, crushed**, in bulk, in open top cars and **stone screenings**, in bulk, in open top cars, in straight or mixed carloads, from Kenneth, Ind., to Waynetown, Ind., 105c; Hillsborough, Ind., 110c; Veedersburg, Ind., 110c per net ton proposed rate. Route: P. R. R.—Crawfordsville, Ind., C. C. C. & St. L. Ry. Present rates, classification basis.

25791. To establish on **gravel and sand**, carloads (See Note 3), from Steubenville, O., to Toronto, O., rate of 50c per ton of 2000 lb., to expire three months from the effective date. Present rate, 60c per ton of 2000 lb.

25792. To establish on **agricultural limestone** (not ground or pulverized), in bulk, in open top cars; **crushed stone**, in bulk, in open top cars, and **stone screenings**, in bulk, in open top cars, in straight or mixed carloads (See Note 3), from Woodville, Gibsonburg and Maple Grove, O., to Detroit, Mich. (P. R. R. delivery), rate of 80c per net ton. Route—Via P. R. R. direct. Present, 90c per net ton.

25793. To establish on (a) **stone, crushed**, in bulk, in open top cars, and **stone screenings**, in bulk, in open top cars, in straight or mixed carloads, from Kenneth, Ind., to Michigan City, Ind. (b) **Sand** (except blast, core, engine, filter, fire or furnace, foundry, glass, grinding or polishing, loam, molding and silica) **and gravel**, carloads, from Kenneth and Lake Ciecott, Ind., to Michigan City, Ind., rate of 105c per net ton. Route—P. R. R., Monticello, C. I. & L. Ry. Present rates—Stone, 127c per net ton; sand and gravel, classification basis.

25794. To establish on **agricultural limestone**, in bulk, in open cars; **crushed stone**, in bulk, in open cars; **stone, rip-rap**, in open cars; **stone screenings**, in bulk, in open cars, and **stone tailings**, in bulk, in open cars (See Note 3), from Greencastle and Limedale, Ind., to points in Indiana, rates as shown in Exhibit "A" attached. Present, as shown in Exhibit "A" attached.

EXHIBIT "A"

From Greencastle, Ind., Limedale, Ind.

To—	Pennsylvania R. R. Rates—Present	Proposed
Penna. R. R.		
Whiting, Ind.	161	135
Indiana Harbor, Ind.	161	135
Gary, Ind.	161	135
East Chicago, Ind.	161	135
Inwood, Ind.	138	125
Bourbon, Ind.	140	125
Etna Green, Ind.	140	125
Atwood, Ind.	145	125
Larwill, Ind.	(1)	125
Howe, Ind.	(1)	135
Portland, Ind.	126	120
Kouts, Ind.	161	125
North Judson, Ind.	161	120
Butler, Ind.	(1)	135
Kentland, Ind.	(1)	125
N. Y. C. & St. L. R. R.		
Handy, Ind.	(1)	105
Templeton, Ind.	(1)	100
Argos, Ind.	(1)	125
	(1)	125
Ft. Wayne, Ind.	(1)	135
Portland, Ind.	(1)	130
Grand Trunk Ry.		
Granger, Ind.	(1)	130
Mishawaka, Ind.	(1)	130
Erie R. R.		
Rochester, Ind.	(1)	125
New York Central R. R.		
Kendallville, Ind.	(1)	145
	(1)	145
Goshen, Ind.	(1)	140
Elkhart, Ind.	(1)	135
B. & O. R. R.		
St. Joe, Ind.	(1)	140
Milford Junction, Ind.	(1)	135
Napanee, Ind.	162	135
Ayr, Ind.	162	135
Bremen, Ind.	162	135
C. & O. R. R.		
Peru, Ind.	(1)	130
Peoria, Ind.	(1)	120

(1) Classification basis.

25795. To establish on **crushed stone**, carloads (See Note 3), from Melvin and Thrifton, O., to Rushville, Ind., Arlington, Ind., Gwynneville, Ind., Morristown, Ind. Proposed rate—(1) 125c net ton; (2) 135c net ton. Present rate, sixth class. (1) From Melvin; (2) from Thrifton.

25798. To establish on **crushed stone and crushed stone screenings**, carloads (See Note 3), from Kokomo, Ind., to N. Y. C. & St. L. (L. E. W. Dist.)

	Pres.	Prop.
Clarence, Ill.	113	105
Paxton, Ill.	340	110
Gibson City, Ill.	340	115
Bloomington, Ill.	370	125
Peoria, Ill.	410	135

25809. To establish on **agricultural limestone, unburned**, in open top cars only; **stone, crushed**, in open top cars, in bulk only; **stone screenings**, in open top cars, in bulk only, in straight or mixed carloads (See Note 3), from Muncie, Ind., to points on the Muncie branch, P. R. R. Proposed rates to following Indiana points:

To—	Proposed	To—	Proposed
Anthony	70	Radley	75
Stockport	70	Cole	80
Wheeling	70	Swayzee	80
Matthews	70	Rich	80
Fowlerton	70	Converse	85
Fairmount	75		

Present—Classification basis.

25810. To establish on **crushed stone**, in bulk, in open cars, **and stone screenings, in bulk**, in open cars, carloads (See Note 3), from Ridgeville, Ind., to Renner, Ind., rate of 65c per net ton. Present, 75c per net ton.

25815. To establish on **cement, common, hydraulic, natural or portland**, carloads, **minimum weight** 50,000 lb., except when the marked weight capacity of car is less, in which event the marked capacity of the car will be the minimum weight but the minimum weight is not to be less than 40,000 lb., to Westchester, Ill., rate of 13c from Cement City Mich., and 15c from Osborne, O. Present, classification basis.

25818. To establish on **plaster, plasterboard, rock, gypsum, etc.**, as described in Note 1, page 13 of C. F. A. L. Tariff 367D, carload minimum weight 40,000 lb., from Grand Rapids, Grandville, Eagle Mills and Wentworth, Mich., to Casco Junction, Luxemburg and New Franken, Wis., rate of 17½c, same as carried to Kewaunee and Green Bay, Wis.

25821. To establish on **crushed stone**, carloads (See Note 3), from North Baltimore, O., rate of 80c to Jewell and 85c per net ton to Okolona, O. Route—Via B. & O. R. R., Defiance and Wabash R. R. Present, 270c per net ton.

25828. To establish on **crushed stone**, carloads (See Note 3), from East Liberty, O., to Condit, O., rate of 95c per net ton. Present, 14½c.

25829. To establish on **crushed stone**, carloads (See Note 3), from Greencastle, Ind., on the C. I. & L. Ry. to East Chicago, Ind., on E. J. & E. Ry. via Dyer, Ind., rate of 140c per net ton. Present, classification basis.

25833. To establish on **crushed stone**, carloads (See Note 3), from Thrifton, O., to Oxford, O., rate of 110c per net ton. Present, 120c per net ton.

25835. To establish on **sand, viz., blast, core, engine, filter, fire or furnace, foundry, glass grinding or polishing, loam, molding and silica**, carloads (See Note 3), from Glass Rock, O., to Crooksville, O., rate of 70c per net ton. Route—Via N. Y. C. R. R. direct. Present, 80c per net ton.

25837. To establish on **dolomite, raw or crude and stone fluxing**, in open top cars, in carloads (See Note 3), Genoa, Martin and Marblehead, O., to Fairmont, W. Va., rate of 206c per ton.

From	Present
Genoa, O.	328c
Martin, O.	328c
Marblehead, O.	450c

25838. To establish on **blocks, building** (solid, hollow or perforated), made of cement or cinder concrete; not reinforced with metal, except enameled, individual blocks not being packed, carloads, minimum weight 60,000 lb., Erie, Penn.

To—	Pres.*	Prop.†
Angola, N. Y.	14	135
Brocton, N. Y.	11½	120
Falconer, N. Y.	13½	150
Silver Creek, N. Y.	13½	135

*In cents per 100 lb. †In cents per ton.

25840.* To establish on **drain tile**, carloads, minimum weight 30,000 lb., from Haviland, O., to following Indiana points:

	Prop.		Prop.
Covington	14	Lebanon	13
Crawfordsville	13	New Ross	13
Danville, Ill.	14	Swannington	13
Lafayette	13	Veedersburg	14

*Cancels W. D. A. 25780.

Route—C. N., Ansonia, C. C. C. & St. L. Ry. Present rates, sixth class.

25841. To establish on flourspar, in packages or in bulk, carloads, minimum weight 60,000 lb., from Freedom, Penn., to Butler, Penn., rate of 135c per ton of 2000 lb. Present, 13c.

25853. To establish on **cement, common, hydraulic, natural or portland**, in straight or mixed carloads, minimum weight 50,000 lb. per car, marked capacity of car to govern if less, from Mitchell, Ind., applicable proportionally on traffic destined to points west of the west bank of the Mississippi river as specified in C. F. A. L. Territorial Directory 3E, under caption, "Trans-Mississippi River Territory."

To	Pres.	Prop.	To	Pres.	Prop.
E. Burlington	16	13	E. Louisiana	16	13
E. Clinton	16½	13	Keithsburg	16	13
E. Dubuque	17	13	Quincy	15¼	13
E. Ft. Madison	16½	13	Rock Island	16	13
E. Hannibal	15½	13	Savanna	16½	13
E. Keokuk	16	13			

25854. To establish on **cement, viz., common, hydraulic, natural or portland**, in straight or mixed carloads, minimum weight 50,000 lb. per car, marked capacity of car to govern if less, to east bank Mississippi river crossings, viz.: E. Burlington, E. Clinton, E. Dubuque, E. Ft. Madison, E. Hannibal, E. Keokuk, E. Louisiana, Keithsburg, Quincy, Rock Island, Savanna, applicable proportionally on traffic destined to points west of the west bank of the Mississippi river as specified in the C. F. A. Territorial Directory 3E, I. C. C. 2008, under caption "Trans-Mississippi River Territory," rate of 14½c from Speed and 12½c from Limedale, Ind. Present, 15½c from Speed, Ind., and 13½c from Limedale, Ind.

25856. To establish on **limestone, ground or pulverized, and limestone dust**, carloads, minimum weight 50,000 lb., from Greencastle, Ind., to East St. Louis and Peoria, Ill., rate of 200c per net ton. Present, 410c per net ton.

25862. To establish on **fluxing stone or raw dolomite**, carloads (See Note 3), from Cleveland, O., rate of 80c to Warren and Youngstown, O., and 70c to Canton and Massillon, O. Note—Rates will only apply on ex-lake traffic. Present, 101c per ton of 2240 lb.

25863. To establish on **rip rap or waste stone**, carloads (See Note 2), from Bedford-Bloomington, Ind., stone district to Beardstown, Ill., on the B. & O. R. R., rate of 200c per net ton. Route—Via C. I. & L. Ry., Roachdale, Ind., B. & O. R. R. Present, 22c.

SOUTHWESTERN FREIGHT BUREAU DOCKET

20757. **Lime**, from Limedale Spur and Ruddells, Ark., to points in Arkansas and Louisiana. To establish a rate of 22½c per 100 lb. on **lime (calcium), viz.: Common, hydrated, quick or slaked**, in straight or mixed carloads, minimum weight 30,000 lb., from Limedale Spur and Ruddells, Ark., to points on the L. & N. W. R. R. Co., viz.: McNeil, Ark., Index 3100 to Bear Creek, La., Index 3240, inclusive. Item 5070-A, S. W. L. Tariff 58-Q, I. C. C. 2175, publishes the suggested rate from Limedale Spur, Ark., and Ruddells, Ark., to other points on L. & N. W. R. R. It is thought that no higher rate should be assessed to stations named above than the 22½c per 100 lb. rate in effect to the other stations on the L. & N. W. R. R.

20765. **Fuller's earth**, from points on the Southern Ry. and Western Ry. of Alabama to points in Texas. To establish a rate of $8 per ton of 2000 lb. on **fuller's earth**, carloads, minimum weight 60,000 lb., from points on the Southern Ry. and Western Ry. of Alabama as shown in Note A, Item 7298-B of S. W. L. Tariff No. 1-Q, to points in Texas, shown in Note B of the above item. All the above seeks to do is to amend routes now applicable via Meridian, Miss., Y. & M. V. R. R., Jackson, Miss., N. O. G. N. R. R. or I. C. R. R. and New Orleans, La., to also apply via Meridian, Miss., G. M. & N. R. R., Jackson, Miss., N. O. G. N. R. R. or I. C. R. R., New Orleans, La.

20772. **Cement**, from Kansas and Oklahoma points to **T.-N. M. Ry.** stations in Texas. To establish **a rate of 34c per 100 lb. on portland, natural or hydraulic cement**, carloads, minimum weight 50,000 lb., except when marked capacity of car used is less, the actual weight, but not less than 40,000 lb., will apply, from Chanute, Fort Scott, Fredonia, Humboldt, Independence, Iola and Mildred, Kan., and Dewey, Okla., to T.-N. M. Ry. stations Cheyenne, Kermit, Wink, Pog and Melat, Tex. It is desired to establish rates from points in Kansas gas belt to stations on the T.-N. M. Ry. based on the I. C. C. Docket 8182 Scale 4 rates, calculated on the distance from Chanute, Kan.

20793. **Plaster board and plaster wallboard**, from Texas and Oklahoma producing points to East St. Louis, Ill. To establish the following rates in cents per 100 lb. as proportional rates on plaster board and plaster wallboard, carloads, as described in Item 11, of S. W. L. Tariff 3-I, to East St. Louis, Ill., to apply on traffic destined points east of the Illinois-Indiana state line and north of the Ohio and Potomac rivers: From Texas producing points, also Eldorado, Okla., 20½c, minimum weight 60,000 lb.; 24½c, minimum weight 30,000 lb. From Oklahoma producing points, except Eldorado, Okla.: 17½c, minimum weight 60,000 lb; 20½c, minimum weight 30,000 lb. It is the purpose of the above to re-establish the former rates as proportional rates in

order to reflect the basis applicable prior to compliance with the commission's order, in I. C. C. Docket 17000, which basis should not have been changed account not being involved in the decision.

20825. **Wall plaster,** from Texas points to Jacksonville, Ala. To establish a rate of 30½c per 100 lb. on wall plaster (including plaster of Paris), carloads, minimum weight 60,000 lb., for Acme, Agatite, Hamlin (M. K. T. of T.), Plasterco, Plasterco Junction, Rotan and Sweetwater, Tex., to Jacksonville, Ala. Shippers state that there will be a movement of wall plaster from Texas producing points to Jacksonville, Ala., and request the establishment of a commodity rate in line with the rates to other southeastern points similarly located.

20827. **Crushed stone,** from New Orleans, La., to Kansas City, Mo. To establish a rate of 35c per 100 lb. on crushed stone, carloads (See Note 3), but not less than 40,000 lb. At the present time there is a movement of crushed stone, carloads, from New Orleans, La., to Kansas City, Mo. The present rate is 56½c per 100 lb. (class E rate), which is higher than the combination on Byram, Miss., Cairo, Ill., E. St. Louis, Ill., of 35c per 100 lb. Shippers request that the latter rate be published, as the present rate is prohibitive.

20835. **Sand and gravel,** from Fort Smith and Van Buren, Ark., to Southwest City, Mo. To establish a rate of 6½c per 100 lb. on sand and gravel, straight or mixed, carloads, minimum weight 80,000 lb., or if marked capacity of car is less than 80,000 lb., marked capacity will govern, from Fort Smith and Van Buren, Ark., to Southwest City, Mo. The suggested rate is higher than the 17,000, Part 11A Scale. It is the 9702 basis and proponent desires to make it applicable pending decision in I. C. C. Docket 17,000, Part 11A. The mileage from Ft. Smith to Southwest City, Mo., is 118.2 miles and from Van Buren, Ark., to Southwest City, Mo., is 112.6 miles.

20848. **Asbestos cement,** from Joplin, Mo., to points in Arkansas and Louisiana. To establish the following rates in cents per 100 lb. on asbestos cement, carloads, minimum weight 40,000 lb., from Joplin, Mo., to points shown below: Arkansas points—Waterloo, 33½c; Smackover, 33½c; Camden, 33½c; El Dorado, 33½c; Little Rock, 33½c; Pine Bluff, 33½c; Hot Springs, 38½c; Texarkana, 33½c; Norphlet, 33½c. Louisiana points—Lestrehan, 57c; Sellers, 57c; Baton Rouge, 57c, and New Orleans, 57c per 100 lb.

The manufacture of asbestos cement was recently started at Joplin, Mo., and the shipper at that point is without sufficient rates to enable him to reach a very extensive territory. Rates were recently authorized from Joplin to Oklahoma and Texas and these are practically the only rates he has in effect today other than full classification rating or combination rates.

20849. **Asbestos cement,** from Joplin, Mo., to points in Kansas. To establish the following rates in cents per 100 lb. on asbestos cement, carloads, minimum weight 40,000 lb., from Joplin, Mo., to points shown bleow:

To—	From Joplin. Rate
Wichita, Kan.	23
El Dorado, Kan.	23
Arkansas City, Kan.	23
Potwin, Kan.	23
Augusta, Kan.	23
Hutchinson, Kan.	23
Salina, Kan.	23
Chanute, Kan.	15
Neodesha, Kan.	15
Coffeyville, Kan.	15
Humboldt, Kan.	15
Pittsburg, Kan.	15
Parsons, Kan.	15

There has recently been established at Joplin, Mo., a plant for the manufacture of asbestos cement. As no rates are in effect from Joplin to points in Kansas except the class basis, it is necessary that rate be established from Joplin in line with the rates from Chicago and St. Louis.

20850. **Asbestos cement,** from Joplin, Mo., to Grand Island, Neb. To establish a rate of 35c per 100 lb. on asbestos cement, carloads, minimum weight 40,000 lb., from Joplin, Mo., to Grand Island, Neb. It is necessary to establish a rate on asbestos cement from Joplin, Mo., to Grand Island, Neb., so as to meet competition from St. Louis and Chicago, inasmuch as the rate from St. Louis to Grand Island is 35c per 100 lb., and it is felt no higher rate can be justified from Joplin. The rate from Chicago to Grand Island is 43c per 100 lb.

20851. **Asbestos cement,** from Joplin, Mo., to Springfield, Mo. To establish a rate of 15c per 100 lb. on asbestos cement, carloads, minimum weight 40,000 lb., from Joplin, Mo., to Springfield, Mo. The distance from Joplin to Springfield, Mo., is only 97 miles, and it is stated the rate suggested for this distance is in keeping with rates of much greater distance than to Springfield.

20864. **Asbestos cement,** from Joplin, Mo., to interstate points. To establish the following rates on asbestos cement, carloads, minimum weight 40,000 lb., from Joplin, Mo., to points shown below (rates in cents per 100 lb.):

To—	
Kansas City, Kan.-Mo.	15
Atchison, Kan.	15
St. Joseph, Mo.	15
Omaha, Neb.	20
Lincoln, Neb.	20
Beatrice, Neb.	20
St. Louis and points grouped therewith	20

St. Louis group begins at St. Louis, Mo., thence north on the west bank of the Mississippi river on and east of the C. B. & Q. through Louisiana, Mo., to Quincy, Ill., thence east by the Wabash through Camp Point, Clayton, Mount Sterling, thence southeast to a junction with the C. B. & Q., thence south on the C. B. & Q. through Winchester, Whitehall and Greenfield, thence southeast to Edwardsville, thence southwest to East St. Louis, taking in the East St. Louis switching district.

Note—The 20c rate to St. Louis and St. Louis group will not apply through the state of Iowa.

To all points in Illinois on and north of the B. & O., B. & O. east to and including Lawrenceville, except those points shown in the St. Louis rate group, 26c.

To all points in Iowa and Wisconsin on and south of the line of the C. M. St. P. & P. from Hudson, Iowa, through Rock Valley, Sheldon, Spencer, Mason City, New Hampton, Colmore and McGregor, Iowa, Prairie du Chien, Lone Rock, Madison, Jefferson and including Milwaukee, Wis., 26c.

At points in Iowa north of the above line, 28c.

At points in Minnesota and Wisconsin in the St. Paul rate group per W. T. L. Territorial Directory 1B, including Sioux Falls, S. D., 28c.

Duluth territory as per W. T. L. Territorial Directory, 30c.

There has recently been established at Joplin, Mo., a plant for the manufacture of asbestos cement. This plant is now without sufficient rates to enable the marketing of this product from Joplin. It is necessary that Joplin have rates to the territory under consideration in this territory comparable to the rates from Chicago and St. Louis.

20804. **Cement,** from southwestern producing points in Oklahoma. To establish the following rates in cents per 100 lb. on cement, carloads, description and minimum weight as per S. W. L. Tariff 128-D, from and to points shown below:

	From		
To—	Kansas City	Chanute	St. Louis
Hovey	24	23½	35
Tracy	24	23½	35
Eva	24	23½	35
To—	Hannibal	Marquette	Foreman
Hovey	32½	37½	32
Tracy	32½	37½	32
Eva	32½	37½	32
To—	Okay Jct.	Ada	Superior
Hovey	32½	24½	25
Tracy	32½	24½	25
Eva	32½	24½	25

The stations to which rates are proposed are on the extension recently completed by the B. M. & E. R. R. west of Hough. It is necessary to publish rates to the new points on the same basis as in effect to other points on the B. M. & E. R. R.

A-355. **Phosphate rock and super phosphate,** from, to and between points in the southwest. To amend the present description of phosphate rock in Item 295 of S. W. L. Tariff 151 and corresponding items in other tariffs issued as result of the I. C. C. Docket 13535 decision applying from, to and between points in the southwest to read as follows: Phosphate rock, crude; super phosphate (acid phosphate), not ammoniated. Minimum weight same as currently provided in Item 295, S. W. L. Tariff 151, and corresponding items in other tariffs issued as result of I. C. C. Docket 13535. It is stated that there has been considerable confusion in the working out of rates on crude phosphate rock due to the fact that at the present time tariffs use the term acidulated phosphate rock and it is felt that the above change will eliminate this confusion.

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

20396. To establish the following mileage scale of commodity rates on **gravel and/or sand,** mixed with asphalt, oil, and/or tar, the weight of the asphalt and/or tar to be not more than 9% of the whole, and the percentage of the mixture to be specified on the bill of lading, carloads (See Note 3), between all stations on the B. & M. R. R. in lieu of the present sixth class rates published in B. & M. R. R. I. C. C. A2540. Rates in cents per ton of 2000 lb.:

Over	0 miles	and not over	20 miles	80
Over	20 miles	and not over	40 miles	90
Over	40 miles	and not over	60 miles	100
Over	60 miles	and not over	80 miles	110
Over	80 miles	and not over	100 miles	120
Over	100 miles	and not over	125 miles	130
Over	125 miles	and not over	150 miles	140
Over	150 miles	and not over	175 miles	150
Over	175 miles	and not over	200 miles	160

Reason—To establish commodity rates on gravel and/or sand, mixed with asphalt, oil and/or tar comparable with those now in effect on other paving materials, and to increase the rate on crushed stone, etc., coated with tar, oil or asphaltum, for distances over 150 miles and not over 155 miles, to the proper basis.

20236. **Crushed stone (trap rock),** in bulk, in gondola or other open-top cars (See Note 3), from Westfield, Mass., to Haverstraw, N. Y. Present rate, 18½c; proposed, $1.80 per net ton. Reason—To establish rates comparable with existing rates for similar distances.

20258. To cancel commodity rates on **limestone, ground, unburned,** from East Dorset, Vt., to D. & H. R. R. stations, as named in Rutland R. R. I. C. C. 5590, and apply in lieu thereof sixth class rates as named in Rutland R. R. I. C. C. 6028. Reason—Cancel obsolete rates.

20267. To cancel commodity rate of $1.45 per net ton on **gravel and sand,** from Rutland, Vt., to Waterbury, Vt., as published in Rutland R. R. V. P. S. C. 951, and apply in lieu thereof sixth class rate of 18c as named in C. V. Ry. I. C. C. A-4940. Reason—Cancel account of being obsolete.

20321. **Stone, broken or crushed** (See Note 2), in bulk, in open cars, from Reed's Gap Siding (Middlefield, Conn.) (Rates in cents per net ton.):

To—	Pres.	Prop.
Cobalt, Conn.	85	60
Easthampton, Conn.	85	70

Reason—To meet motor truck competition.

20340. To cancel present commodity rates applying on **limestone, crude, crushed or ground,** from East Dorset, Vt., to stations on the D. & H. R. R. as published in Rutland R. R., I. C. C. No. 5934, and apply in lieu thereof sixth class rates as named in Rutland R. R., I. C. C. 5370. Reason—Commodity not produced at present.

20430. **Rock, crushed serpentine,** carloads (See Note 2), but not less than 80,000 lb., from Hyde Park, Vt., to Somerville, Mass. Present, 24½c per 100 lb.; proposed, 225c per net ton. Reason—To establish commodity rate that will move the traffic.

20447. **Stone, crushed,** carloads, in bulk, in gondola or other open cars (See Note 3), to Winsted, Conn., from Westfield, Mass. (Hampden Quarry). Proposed, 85c per net ton, and New Britain, Conn. (Cook's Quarry), 75c per net ton. Present, commodity rates as per N. Y. N. H. & H. R. R., I. C. C. F-2795. Reason—To meet motor truck competition.

20449. **Fluorspar, carloads,** minimum weight 50,000 lb., from New York Lighterage, N. Y., to Worcester, Mass., present, 24c; proposed, 350c per gross ton. Bridgeport, Conn., present, combination; proposed, 325c per gross ton. Reason—Proposed rate is necessary to take care of movement of this traffic.

WESTERN TRUNK LINE DOCKET

496-R. Minimum weight. **Ground limestone,** from Louisville, Seymour Park and Weeping Water, Neb., to Eau Claire, Wis., Duluth and Twin Cities, Minn. Minimum weight—Present, 90% of marked capacity of car, except that when actual weight of car is less than 90% of the marked capacity of car, the actual weight will be the minimum, but in no case shall the minimum be less than 40,000 lb. Proposed, 90% of the marked capacity of car, except that actual weight will govern where car is loaded to full visible capacity, but not less than 40,000 lb.

2030-B. **Asphalt coated crushed stone,** carloads (See Note 1), but not less than 50,000 lb., except when car is loaded to full visible or special carrying capacity, in which case actual weight will govern, from Ft. Scott, Kan., to points in Kansas and Missouri. Rates: Present—Class "D," S. W. L. Tariff 151, Agent J. E. Johanson's I. C. C. 2008. Proposed (rates in cents per 100 lb.):

To—	
Chetopa, Kan.	6
Columbus, Kan.	4½
Dearing, Kan.	6½
Emporia, Kan.	8
Galena, Kan.	4½
Harrisonville, Mo.	7½
Independence, Kan.	7½
Jefferson, Mo.	6½
Joplin, Mo.	4½
Kansas City, Mo.	7½

2030-C. **Asphalt coated crushed stone,** carloads (See Note 1), but not less than 50,000 lb., from Ft. Scott, Kan., to stations on the M. K. T. R. R. in Missouri and Kansas. Rates: Present—Class "D" rates, S. W. L. Tariff 151, Agent J. E. Johanson's I. C. C. 2008. Proposed—Same scale of rates as is at present applicable from Galena, Kan., and Joplin, Mo., under Item 90A of M. K. T. Tariff 3015J.

2030-B. **Asphalt coated crushed stone,** carloads (See Note 1), but not less than 50,000 lb., except when car is loaded to full visible or special carrying capacity, in which case actual weight will govern, from Ft. Scott, Kan., to points in Kansas and Missouri.

2030-C. **Asphalt coated crushed stone,** carloads (See Note 1), but not less than 50,000 lb., from Ft. Scott, Kan., to stations on the M. K. T. R. R. in Missouri and Kansas.

2188-C. **Stone,** carloads (as described in Item 670, W. T. L. Tariff 79Q), from Kasota, Minn.,

to Eastern Trunk Line destinations, as named in Item 670, W. T. L. Tariff 79Q. Rates: Present—As named in Item 670 of W. T. L. Tariff 79Q. Proposed—To representative points (in cents per 100 lb.):

	Group "B"	Group "C"	Group "A"
Albany, N. Y.	32	48	41½
Baltimore, Md.	32½	46½	40
Boston, Mass.	35½	51½	45
New York, N. Y.	33½	49½	43

5781-A. Industrial switching at Quincy, Ill., on **limestone, crushed stone, lime, sand and gravel.** Present, 2c per 100 lb., minimum $8.10 per car; proposed, 30c per ton, minimum $8.10 per car.

7270-A. **Crushed stone** and articles grouped therewith, from Dell Rapids, S. D., to Swea City, Iowa. Rates: Present—211c per net ton, Estherville, Iowa, combination, based 150c per net ton to Estherville, per C. M. St. P. & P., G. F. D. No. 9805-series, balance beyond, per W. T. L. Tariff 160-series. Proposed, 150c per net ton.

7357. **Sand and gravel,** treated with oil or asphalt, carloads, from points in Nebraska to points in Nebraska; also points in Nebraska to points in Iowa. Rates—Present, no rating in effect. Proposed—1c per 100 lb. or 20c per net ton over the Nebraska scale of rates applicable on sand and gravel as published in Item 190 of C. B. & Q. G. F. O. 16830A for single line hauls and Item 50 of W. T. L. Tariff 175 for joint line hauls.

7359. **Stone, crushed, ground or broken,** carloads (See Note 3). In no case shall the minimum weight be less than 40,000 lb. From Osage and Floyd, Iowa, to Janesville, Wis. Rates—Present, 240c per ton of 2000 lb.; proposed, 220c per ton of 2000 lb.

2292-G. **Stone, broken, crushed or ground** carloads (See Note 2), but not less than 40,000 lb.; when loaded in hopper bottom ore cars, 75,000 lb. (except as noted). Exception—Minimum carload weight on crushed stone, 90% of marked capacity of car, except that when actual weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will be the minimum weight. In no case shall the minimum weight be less than 40,000 lb. From Randville, Mich., to East St. Louis, Ill., and St. Louis, Mo. Rates—Present, 18c per 100 lb. per Item 3100 of Boyd's Tariff 6P; proposed, 16½c per 100 lb.

7362. **Stone,** per Item 1810 of E. B. Boyd's Tariff 49-R, from Carter's Switch, Houghton and Ishpeming, Mich., to Hamilton, Ont., Pittsburgh, Penn., Toronto, Ont. Description—Present, as described in Item 1810 of E. B. Boyd's Tariff 49-R; proposed, correct description to read "rough stone."

6983-B. **Glass sand,** carloads (See Note 2), from Browntown, Wis., to various stations in Oklahoma. Rates—Present, Class E, per Agent Johanson's Tariff 15; proposed, to representative points: Ada, Oklahoma City, Okla., 25c; Blackwell, Henryetta, Sand Springs, Tulsa, Okla., 22.5c. Complete copy of the exhibit will be furnished on request.

5547-E. Mixed carloads, **lime, Keene's cement and/or wall plaster** and articles taking wall plaster rates, mixed carloads, from Medicine Lodge, Kan., to destinations in W. T. L., S. W. L., S. F. A., C. F. A., etc., and N. E. F. A. territories. Present—Class rates apply. Proposed—The request is to include common lime in commodity descriptions now provided in the tariffs so as to provide mixed carload rating as follows: "Lime may be shipped in mixed carloads with Keene's cement and/or wall plaster and articles taking wall plaster rates, provided that the weight of the lime does not exceed 25% of the weight of the entire shipment. Actual weight to apply on the lime contained in the car, at rate of 3c per 100 lb. higher than the rate applicable on plaster. On the balance of the carload the current carload rates to apply on the actual weight. Entire carload to be subject to the minimum weight applicable on plaster, and if the actual weight of the entire carload is less than such minimum weight, the deficit will be charged for at the plaster carload rate."

5547-E. Mixed carloads **lime, Keene's cement and/or wall plaster** and articles taking wall plaster rates, mixed carloads, from Medicine Lodge, Kan., to destinations in W. T. L., S. W. L., S. F. A., C. F. A., E. T. L. and N. E. F. A. territories.

TRUNK LINE ASSOCIATION DOCKET

24042. **Crushed stone,** carloads (See Note 2), from Shackamaxon station, Philadelphia, Penn. Rates in cents per net ton.

To	Pres.	Prop.	To	Pres.	Prop.
Ardmore	90	70	Wayne	105	75
Bryn Mawr	90	70	Strafford	105	75
Rosemont	90	70	Devon	105	80
Villanova	105	75	Berwyn	105	80
Radnor	105	75	Paoli	105	80
St. Davids	105	75			

24276. **Stone, natural** (other than bituminous asphalt rock), **crushed,** coated with oil, tar or asphaltum, carloads (See Note 2), from South Amsterdam, N. Y., to N. Y., N. H. & H. R. R. points, Fitchburg, Webster, Deerfield, Northampton, Holyoke, Lenox, Lee, West Stockbridge, Housatonic, Great Barrington, **Ashley Falls and various** rates ranging from 155c to 205c per net ton. (Present rates, sixth class.) Reason—Proposed rates are comparable with rates from South Bethlehem, N. Y., to same points.

24279. **Crushed stone, quarry, waste and refuse,** carloads, from Bittinger, Penn., to Hanover, Penn., $20 per car. (Present rate, 60c per net ton.) Reason—To meet motor truck competition.

24280. To increase rate of 50c to 65c per 100 lb. on **sand and gravel,** other than blast, engine, foundry, glass, molding or silica, carloads, from Alfred, N. Y., to Andover, N. Y. Reason—The road job for which the present rate was published is now complete and it is desired to place rate on the proper basis.

24282. **Crushed stone,** carloads (See Note 2), from Steelton, Penn., to Pottsville, Penn., 105c per net ton. (Present rate, 115c per net ton.) Reason—Proposed rate is same as published from Steelville to Pottsville (12th St.), Penn.

24287. **Slag,** carloads (See Note 2), from Catasauqua, Penn., to Haucks and Treskow, Penn., 90c per net ton. (Present rate 115c per net ton.) Proposed rate is comparable with rates on crushed stone from White Haven and Northampton, Penn., to Treskow, Penn.

24289. **Crushed stone,** carloads (See Note 2), from Suffern, N. Y., to Shohola, Penn., 100c per net ton. (Present rate, 140c per net ton.) Reason—Proposed rate is comparable with rates from Mahwah, N. J., to Sterling Forest, Blairstown, Vails, N. J., etc.

24294. **Slag,** in bulk, carloads (See Note 2), from Reading, Birdsboro, Pottstown and Coatesville, Penn., to stations on the C. R. R. of N. J., Fairton, N. J., to Divalve, N. J., inc.; Shiloh Crossing, N. J., to Greenwich, N. J., incl., Greenwich Pier, N. J., to Bayside, N. J., incl., 160c per net ton. Reason—Proposed rate is comparable with rates from Bethlehem, Penn.

24296. **Slate, roofing,** carloads, minimum weight 40,000 lb., from Fair Haven, Penn., to Castleton, Vt., incl., and Poultney, Vt., to West Pawlet, Vt., incl., to Hamilton, Ont., 28c per 100 lb. (Present rate, 34c per 100 lb., sixth class.) Reason—Proposed rate compares favorably with rates to Toronto, Ont.

24297. **Cement,** carloads, from **Birmingham,** Ala., to Tarrytown, N. Y., 35½c per 100 lb. (Present rate, 40½c per 100 lb.) Reason—Proposed rate is comparable with rates on like commodities for like distances and conditions.

24298. Cancel commodity rates on **sand (molding),** carloads, from Great Meadows, N. J., to points in New Jersey, New York and Pennsylvania as published in L. & H. R. Ry. I. C. C. A1635. Classification basis to apply. Reason—Investigation develops no traffic has moved for some time, nor is there prospects for future shipments, therefore rates are obsolete.

24300. To cancel rates on **lime (agricultural, chemical and building),** carloads, from Hamburg and Lime Crest, N. J., to local points on the L. & H. R. Ry., Maybrook, N. Y., to Easton, Penn., and to points in Connecticut, New Jersey, New York and Pennsylvania, as published in L. & H. R. Ry. I. C. C. A1700. Classification basis to apply. Reason—Investigation develops no traffic has moved for some time, nor is there prospects for further movements, therefore rates are obsolete.

24321. **Cement,** carloads, to stations on the Quakertown and Bethlehem railroad, Richlandtown to Durham, Penn., incl., from Binnewater, 13½c, and from Brixment, Buffalo and Black Rock, N. Y., 18½c per 100 lb. Reason—Proposed rates are comparable with rates from Lehigh district.

24324. **Sand and gravel,** other than blast, engine, foundry, glass, molding or silica, carloads (See Note 2), from Alfred, N. Y., to Penfield, Penn., 140c per net ton. Present rate, 160c per net ton. Reason—Proposed rate is comparable with rates from Erie, Penn., and Pittsburgh, Penn., to Penfield, Penn.

24329. **Sand,** other than blast, engine, foundry, molding, carloads (See Note 2), from Carpenterville, N. J., to Easton, Penn., 50c per net ton. (Present rate, 60c per net ton.) Reason—To meet motor truck competition.

24345. **Slag, crude or crushed,** carloads (See Note 2), to following Pennsylvania points (rates in cents per 2000 lb.).

From Coatesville. To	Prop.	Pres.
Devon	80	90
Ardmore	80	90
Chester	80	85
Eddystone	80	105
From Pottstown. To	**Prop.**	**Pres.**
Devon	80	90
Ardmore	80	90
Chester	....	....
Eddystone	....	....
From Birdsboro To	**Prop.**	**Pres.**
Devon	80	115
Ardmore	90	115
Chester	....	....
Eddystone	....	....

Reason—Proposed rates are fairly comparable with rates to Hamburg, Wawa and Chadds Ford Junction, Penn.

24355. **Sand,** other than blast, engine, foundry, molding, glass, silica, quartz or silex **and/or gravel,** carloads (See Note 2), from Arundel, Md., to Cedarville to Forest Hall, Md., inclusive, 125c per net ton. (Present rate, 145c per net ton.) Reason—To meet motor truck competition.

24366. **Stone chips or granules** (roofing granules, carloads (See Note 2), from Advance and Glad Hill, Penn., to Toronto and West Toronto, Ont., 426c per gross ton. (Present rate, 471c per gross ton.) Reason—Proposed rate is comparable with rates from and to points in the same general territory.

24371. **Sand,** carloads (A) shipped in open top cars; (B) shipped in box cars or closed equipment (See Note 2), from Toms River, N. J., to Clarksburg and Lumberport, W. Va. (A) 310c and (B) 340c per net ton. Reason—Proposed rates are comparable with rates from Cape May, N. J., and Lewes, Del., to Clarksburg, W. Va.

24377. **Sand, blast, engine, fire, foundry, glass, molding and silica,** carloads (See Note 2), from Stuyvesant, N. Y., to Peekskill, N. Y., 160c per net ton. (Present rate, 180c per net ton.) Reason—Proposed rate is comparable with rates on molding sand from Rhinecliff, N. Y., to Yonker, N. Y., and from Newton Hook, N. Y., to Rome and Greenway, N. Y.

24378. **Stone, crushed or broken,** carloads (See Note 2), from Oriskany Falls, N. Y., to Rome, N. Y., 65c per net ton. (Present rate, 75c per net ton.) Reason—Proposed rate is comparable with rates on like commodities from and to points in the same general territory.

24387. (A) **Building lime,** carloads, minimum weight 30,000 lb. (B) **Agricultural and land lime,** carloads, minimum weight 30,000 lb. (C) **Chemical, gas and glass lime,** carloads, minimum weight 30,000 lb. (D) **Ground limestone,** carloads, minimum weight 50,000 lb. From Ashcom, Penn.:

	Proposed rates			
To—	(A)	(B)	(C)	(D)
Port Allegheny, Penn.	16½	16	16	....
Russell, Penn.	17	13½	17	....
Tionesta, Penn.	17	13½	17	....
Portville, N. Y.	16½	16	16	16

The above rates in cents per 100 lb. (Present rates, sixth class rates.) Reason—Proposed rates are comparable with rates from Ashcom, Penn., to Rochester, N. Y., and from York, Penn., to Russell and Tionesta, Penn.

24389. **Sand,** carloads, (A) in open top cars, (B) in box cars or closed equipment (See Note 2), from Raritan River R. R. points (rates in cents per 2000 lb.):

	Proposed rate	
To—	(A)	(B)
Carlisle, Penn.	230	250
Columbia, Penn.	205	225
Elizabethtown, Penn.	220	240
Eddystone, Penn.	150	160
Hanover, Penn.	230	250
Lebanon, Penn.	220	240
Pottstown, Penn.	165	185
Phoenixville, Penn.	160	180
York, Penn.	230	250

Reason—Proposed rates are comparable with rates from Cape May, N. J., to same points.

24390. **Stone, natural** (other than bituminous asphalt rock), **crushed,** carloads (See Note 2), from Feura Bush, N. Y., and South Bethlehem, N. Y., to stations on the Harlem and Putnam division of the N. Y. C. R. R. Rates ranging from 90c to 145c per ton. Reason—Proposed rates compare favorably with rates from New Hamburg, N. Y., to Mt. Vernon, Millerton, Brewster, Pawling, N. Y., etc.

24393. **Sand,** carloads, N. O. I. B. N., in open cars (See Note 2), to Danville, Que. (rates in cents per 100 lb.):

From—	Proposed	Present
Tullytown, Penn.	27	34½
Philadelphia, Penn.	27	34½
Trenton, N. J.	27	34½
Yardville, N. J.	27	34½
Fieldsboro, N. J.	27	39½
Roebling, N. J.	27	34½
Riverside, N. J.	27	34½
Arch St., Palmyra, N. J.	27	34½
Masonville, N. J.	27	34½
Hainesport, N. J.	27	34½
Mt. Holly, N. J.	27	34½
Birmingham, N. J.	29	39½
Honey Brook, N. J.	27	34½
Narvon, Penn.	27	34½
Harrisburg, Penn.	27	34½
Newport, Del.	27	34½
Wilmington, Del.	27	34½
North East, Md.	27	34½
Conowingo, Md.	27	34½
Baltimore, Md.	27	34½
Vineland, N. J.	29	39½
South Vineland, N. J.	29	39½
Clayville, N. J.	29	39½
Millville, N. J.	29	39½
Menantico, N. J.	29	41½
Manumuskin, N. J.	29	41½
Belleplain, N. J.	29	41½
Mt. Pleasant, N. J.	29	41½
Cape May, N. J.	29	41½

Reason—Proposed rates are fairly comparable with rates to St. Hyacinth, Que.

24039, Sup. 2. **Lime, building, agricultural, land, chemical, gas or glass,** carloads, minimum weight 30,000 lb., from Billmyer, Knickerbocker, Howellville, Rambo, Plymouth Meeting, Blue Bell, Union Stone Co., Bainbridge and Devault, Penn., to Mt. Vernon, N. Y., and Wykagyl, N. Y., 19½c per 100 lb.; Heathcote and White Plains, N. Y., 22½c per 100 lb.; also from Bellfonte and Pleasant Gap, Penn., to Mt. Vernon and Wykagyl, N. Y., 22c per 100 lb., and also correct the minimum weight as shown in the original Proposal and Sup. No. 1 to read 30,000 lb. on all commodities.

23887, Sup. 1. **Agricultural lime,** carloads, minimum weight 30,000 lb., from Avis, Penn., to Pusher Siding and Newfield, Penn., 15½c per 100 lb.

24396. (A) **Lime,** carloads, minimum weight 30,000 lb.; (B) **limestone, ground, unburned,** carloads, minimum weight 50,000 lb., from Jordanville, N. Y. (rates in cents per 100 lb.):

To (L. I. R. R.)	(A)	(B)
Group A	17	16
Group B	19½	18½
Group C	20½	19½
Group D	23½	22½

Reason—Proposed rates are same as in effect from Bellefonte, Penn.

24398. **Stone, rubble,** carloads, minimum weight 50,000 lb., to Washington, D. C., from Grove, Md., 105c and from Stephens City, Va., 126c per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

24400. **Crushed stone,** carloads (See Note 2), from Montclair Heights and Upper Montclair, N. J., to Shohola, Penn., 120c per net ton. Present rate, 160c per net ton. Reason—Proposed rate compares favorably with rates from Water Gap, Penn., to Thompson and Shohola, Penn.

24401. To cancel commodity rates on **sand and gravel, common and molding,** carloads (See Note 2), from Almond, N. Y., to various points as shown in Erie R. R. Tariffs I. C. C. 18482 and 18485. Class rates to apply. Reason—Investigation develops that there has been no movement for some time, nor is there any prospect of future movement, therefore rates are obsolete.

24402. To cancel all commodity rates on **sand and gravel,** carloads, from Hornbrook, Chestnut Hill, Woodland, Colfax, Consol. 26 and Kingmont, W. Va., to destinations in Maryland, Ohio, Pennsylvania and West Virginia as named in B. & O. R. R. Tariff I. C. C. 21218; also from Chestnut Hill, Whitaker and Woodland, W. Va., to destinations in Ohio, as named in B. & O. R. R. I. C. C. 21643. Classification basis to apply. Reason—Investigation develops that there has been no movement, nor is there prospect of future movement, as sand operations have been abandoned, therefore rates are obsolete.

24404. **Crushed stone,** carloads (See Note 2), from Rock Hill, Penn., to Oxford Road (Philadelphia), Penn., 110c per net ton. Present rate, 140c per net ton. Reason—Proposed rate is comparable with rate on like commodities for like distances, services and conditions.

24406. To cancel commodity rates on **crushed stone,** carloads (See Note 2), from Corning, N. Y., to various points, as published in Erie Tariffs I. C. C. 18482 and 18485. Classification basis to apply. Reason—Investigation develops that there has been no movement for some time, nor is there prospect of future movement, therefore rates are obsolete.

24419. **Sand** (other than blast, engine, foundry, glass, molding or silica) **and gravel,** carloads (See Note 2), from Noxen, Penn., to stations on the Lehigh Valley R. R., Easton, Bethlehem, Lehigh Gap, Hazleton, Pittston, Towanda, Sayre, Penn., and various, rates ranging from 80c to 120c per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

24420. **Sand,** other than blast, foundry, glass, loam or molding, carloads (See Note 2), **and gravel** (See Note 2), from Wheeling, Moundsville, Wells Pit, New Martinsville, Parkersburg, Benton Ferry and Fairmount, W. Va., to points on the B. & O. R. R. east of the Maryland-West Virginia state line. Hutton, Bloomington, Md., Luke, Rawlings, Md., Piedmont, Petersburg, W. Va., Cumberland, Md., and various rates ranging from 90c to 220c per net ton. Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

24424. To amend page 66 of Sup. 25 to Agent Curlett's Tariff I. C. C. A265, covering rates on **cement, from Trunk Line** to Canadian points by adding stations on the Port Colborne branch of the T. H. & B. Ry., Indices 61326 and 81328, inclusive, on same basis of rates as now in effect to Welland, Ont., also correct rates shown to Ranges, Index 81255, to the same basis of rates as now applicable to Dundas, Ont., Index 81260.

24425. To cancel all commodity rates, both carloads and less than carloads, on **soapstone and soapstone products,** including **crushed or ground soapstone,** from Norwood, Va. (when from beyond), to all destinations in Trunk Line, New England and C. F. A. territories. Classification basis to apply. Reason—The plant at Norwood, Va., has been abandoned, therefore rates are obsolete.

24428. **Cement,** carloads, to stations on the Southern Ry., Seminary, Va., to Harrisonburg, Va., incl., from Binnewater, N. Y., rates ranging from 17½c to 23c per 100 lb., and from Brixment, N. Y., rates ranging from 20c to 25½c per 100 lb. Reason—Proposed rates are based on I. C. C. Docket 15806 scale.

M-1489. To establish rate of 250c per net ton on **crude gypsum rock,** carloads (See Note 2), but not less than 80,000 lb., from Oakfield-Garbutt-Victor districts to:

Alsen, N. Y.
Binnewater, N. Y.
Glens Falls, N. Y.
Hagerstown, Md.
Howes Cave, N. Y.
Hudson, N. Y.
Hudson Upper, N. Y.
Lehigh District.
Manheim, W. Va.
Martinsburg, W. Va.
Security, Md.
Swedeland, Penn.
Union Bridge, Md.
Universal, Penn.
West Conshohocken, Penn.
West Winfield, Penn.
York, Penn.

ILLINOIS FREIGHT ASSOCIATION DOCKET

5791. **Sand and gravel,** carloads (See Note 2), but not less than 40,000 lb., from Sheridan, Ill., to Yorkville, Ill. Present rate, 60c; proposed, 50c per net ton.

5792. **Crushed stone,** carloads (See Note 3), from Pontiac, Ill., to destinations on Wabash Ry., etc., to (following representative points): Proposed—Decatur, Ill., 88c; Altamont, Ill., 115c; Danville, Ill., 110c; Streator, Ill., 63c; E. St. Louis, Ill., 135c. Present, classification rates.

2666-A. **Crushed stone** (in bulk) and articles taking same rates, viz.: **Rough** (not dimension or dressed) **rubble, riprap, etc.,** carloads, from Lehigh, Van's Siding, West Kankakee, Ill., to St. Anne, Ill. Present rate, 76c; proposed, 63c per net ton.

4265-Sub. 1. **Sand,** carloads (See Note 1), from Chester, Ill., to Buncombe and West Vienna, Ill. (Rates per net ton). Present, 112c; proposed, 101c.

5193, Sub. 2. **Sand, blast, engine, foundry, glass or molding,** carloads (See Note 1), from Bowes, Ill., to Michigan City and South Bend. Rates per net ton.

To	Pres.	Prop.
Michigan City, Ind.	Class	$1.39
South Bend, Ind.	Class	1.60

SOUTHERN FREIGHT ASSOCIATION DOCKET

51425. **Phosphate rock** from Mobile, Ala. (on coastwise traffic originating at Florida points) to St. Louis, Mo., E. St. Louis, Ill., and Memphis, Tenn. It is proposed to establish the following reduced rates on phosphate rock, other than ground, carloads, minimum weight 80% of marked capacity of car, from Mobile, Ala. (on coastwise traffic originating Florida points): To Memphis, Tenn., 243c per ton of 2240 lb.; to St. Louis, Mo., and E. St. Louis, Ill., 347c per ton of 2240 lb. The suggested rates not to include wharfage and handling charges.

51443. **Crushed stone** from New Orleans, La., to Kansas City, Mo. Present rate, 56½c. Proposed rate on crushed stone (See Note 3), but not less than 40,000 lb., from New Orleans, La., to Kansas City, Mo., 35c per 100 lb., not to be subject to Agent Jones Combination Tariff, I. C. C. U. S. 1. The suggested rate is based on combination on Byran, Miss.-Cairo, Ill.-E. St. Louis, Ill.

51468. **Feldspar,** from Erwin, Tenn., Minpro, Spruce Pine, Toecane, Bowditch and Cane Branch, N. C., to Cordova, Ala. Present rates, lowest combination. It is proposed to establish on feldspar, carloads, minimum weight 50,000 lb., rates of 443c from Minpro, Spruce Pine and Toecane, N. C., and 479c per net ton from Bowditch and Cane Branch, N. C., to Cordova, Ala. The suggested rates are based 60c per net ton higher than at present in effect to Birmingham, Ala., that representing the 6th class difference.

51479. **Crushed stone,** from Big Stone Gap and Glenita, Va., to N. & W. Ry. stations, Saltville and Abingdon branches. Present rates, lowest combination. It is proposed to establish rates on crushed stone (except bituminous rock or bituminous asphalt rock), carloads (See Note 3), from Big Stone Gap and Glenita, Va., to N. & W. Ry. stations on the Saltville and Abingdon branches, on basis of the I. C. C. Docket 17517 joint line scale to Saltville Branch stations, and I. C. C. Docket 15216, Buckland Scale to Abingdon Branch stations.

51496. **Stone, fluxing,** carloads, from Whitehead, Tenn., to Sheffield, Ala., and Rockdale, Tenn., and from Carter's Creek, Tenn., to Sheffield, Ala. It is proposed to cancel, on the obsolete theory, commodity rates on fluxing stone, carloads, from and to the points mentioned. I. C. C. Docket 17517 rates will apply following cancellation.

51498. **Stone, crushed or rubble,** from Boxley, Va., to Ivor, Va. Present rate, Petersburg combination of 170c per net ton. It is proposed to establish on stone, crushed or rubble, carloads (See Note 3), rate of 130c per net ton from Boxley, Va., to Ivor, Va., based on the Buckland joint line scale prescribed in I. C. C. Docket 15216.

51508. **Fullers earth,** as described in Item 8704 of Agent Speiden's General Export Tariff, I. C. C. 1324, from Gantt, Ala., to Mobile, Ala., and Savannah, Ga., for export. It is proposed to cancel, under the obsolete theory, commodity rates on fullers earth from and to the points mentioned. Class rates will apply following cancellation.

51512. **Phosphate rock,** from Mobile, Ala., applicable on coastwise traffic originating at points in Florida, to Ohio River crossings. It is proposed to establish rate of 347c per gross ton (not to include wharfage and handling charges) on phosphate rock (other than ground phosphate rock, slush and floats [refuse and washings from phosphate rock]), and soft phosphate, carloads, minimum weight 80% of marked capacity of car, from Mobile, Ala., on traffic moving via water to Mobile when originating at Florida points, to Ohio River crossings. The suggested rate is made the same as recently proposed from Mobile, Ala., to St. Louis, Mo., and East St. Louis, Ill.

51555. **Phosphate rock,** from Pensacola, Fla., to St. Louis, Mo., East St. Louis, Ill., and Memphis, Tenn. It is proposed to establish the following reduced rates on phosphate rock (other than ground phosphate rock, slush and floats [refuse and washings from phosphate rock] and soft phosphate), carloads: To St. Louis, Mo., and East St. Louis, Ill., 347c per gross ton; to Memphis, Tenn., 243c per gross ton. The suggested rates are made with relation to rates previously proposed from Mobile under Submittal 51425.

51557. **Stone,** from Whitestone, Ga., to South Bend and Logansport, Ind. Present rates, to South Bend, 464c; to Logansport, 437c per net ton. It is proposed to reduce present commodity rates to South Bend and Logansport, Ind., to be 423c per net ton, same as currently in effect from Bolivar and Fairmount, Ga., and same as published from Whitestone, Ga., to Chicago, Ill.

51558. **Stone, granite or marble,** from New Orleans, La., to Atlanta, Ga. It is proposed to establish, in lieu of combination, through rate of 24½c per 100 lb. on stone, granite or marble, viz.: Blocks or slabs, hammered, chiseled or polished, boxed or crated, carloads, minimum weight 30,000 lb. The suggested rate is made same as currently in effect to Athens, Augusta, Macon and Columbus, Ga.

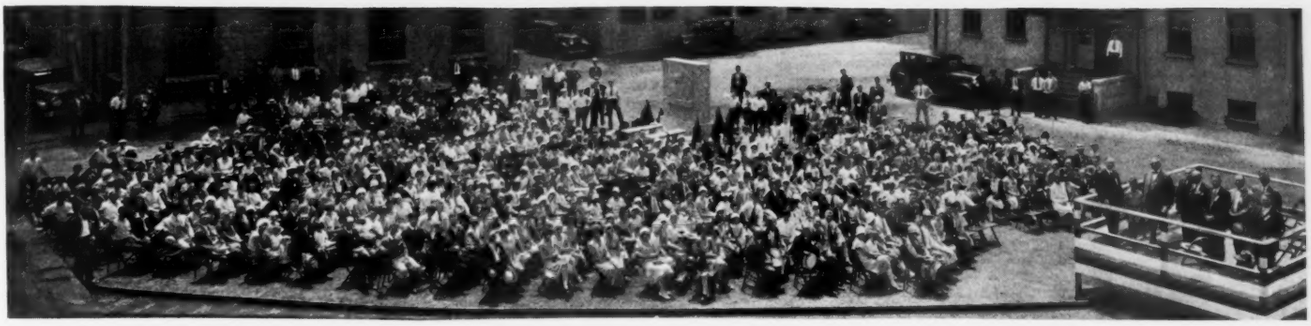
51577. **Dolomite,** from Cincinnati, O., to Bessemer, Thomas and Woodward, Ala. It is proposed to establish, in lieu of lowest combination, commodity rate of 17c per 100 lb. on dolomite, roasted, carloads, minimum weight 40,000 lb., from Cincinnati, O., to Bessemer, Thomas and Woodward, Ala., which rate is made same as currently in effect to Birmingham, Ala.

51578. **Talc,** from Hemp and Glendon, N. C., to Toronto, Ont. Present rate, 1045c per net ton. It is proposed to cancel present commodity rate of 1045c per net ton on talc, crude or ground, carloads, minimum weight 50,000 lb., from Hemp and Glendon, N. C., to Toronto, Ont., permitting Cincinnati, O., combination of 909c per net ton to apply after cancellation.

51589. **Sand, gravel, stone, slag and chert,** from Birmingham, East Birmingham, Dolcito and Ensley, Ala., to Meadows, Lovett and Manning, Ga. It is proposed to revise present rates on sand, gravel, stone, slag and chert, carloads, as described in Item 5A of Agent Glenn's I. C. C. A655, to reflect the I. C. C. Docket 17517 scale for the short line distance from origin to destination, resulting in rate of 180c per net ton from Birmingham, East Birmingham, Dolcito and Ensley, Ala., to Meadows, Lovett and Manning, Ga.

Development of Glass Sands of Nevada

CONSIDERABLE INTEREST has lately been manifested in certain glass sand deposits in Clark county in southern Nevada. One deposit is in the form of a cross-bedded sandstone and is said to be very extensive. Analyses submitted to the United States Bureau of Mines, Department of Commerce, indicate a silica content of 98.90%, iron oxide 0.05%, alumina 0.65%, and lime 0.05%. Such sand is suitable for the manufacture of many types of glass, and several thousand tons of the sand are being sold annually to glass factories in California. Recently attention has been directed to a reported deposit of high grade glass sand near Steamboat Springs south of Reno in Washoe county.



Officials, employes, families and friends made the dedication of the Great Lakes Portland Cement Corp. safety trophy at Buffalo a momentous occasion

Great Lakes Employes Dedicate Trophy

Celebrations Held at Buffalo, Stockertown, Penn., and Cowell, Calif., Indicate Widespread Influence of Safety Idea

JULY 23 PROVED a red letter day in the history of the Great Lakes Portland Cement Corp. Nearly 1,000 persons, including officials and employes and their families, representatives of various public bodies and invited guests from other cities, assembled at the plant at 1 p. m. to dedicate the safety trophy awarded to the mill by the Portland Cement Association and to celebrate a year of operation without mishap.

President Adam L. Beck of Great Lakes presided and was assisted in the conduct of the dedication exercises by A. T. BeVier, superintendent, J. B. Zook, chief engineer and Marshal Beck, treasurer. After an invocation by Rev. Frank O. Leonard of Buffalo, the trophy was presented and unveiled by Misses Margaret McHugh, Norma Weaver, Dorothy Then and Betty Jane Taylor, daughters of company employes.

Mr. Zook accepted the monument on behalf of the plant organization and pledged untiring efforts to keep the record free from accidents. There have been no injuries to workmen sufficient to cause loss of time since December 19, 1928. Following Mr. Zook's remarks, Lt. Col. H. A. Reninger spoke to the workmen and their families, particularly the latter, regarding safety in the community and in the home.

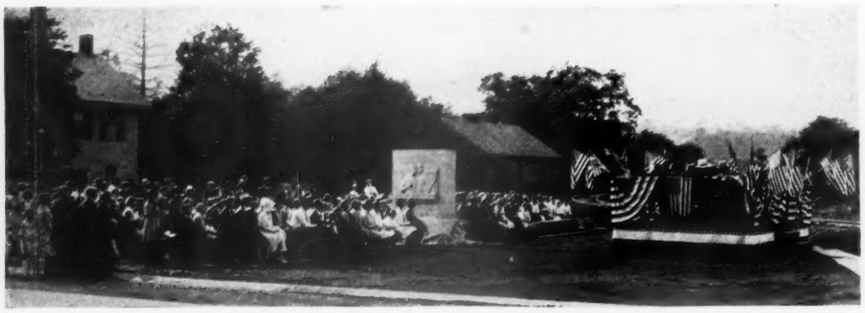
William J. Guilbert, director of safety of the Buffalo Chamber of Commerce, stated that the Great Lakes plant had earned the admiration of the community in which it is located and provided both a valuable example for other industrial plants and a record for the ambitious to shoot at. He emphasized the opportunity of well-organized plant safety organizations to fight the appalling increase in street and other community accidents.

At the close of the ceremony a large fleet of motor busses conveyed the crowd to the Commercial Street docks, where the party boarded the steamer *Canadiana* for a cross-lake trip to Crystal Beach, Canada. The company provided each adult and child with round trip transportation and a strip of ten coupon tickets for use within the Crystal Beach amusement park. A program of "athletic" events arranged by the committee took place in the Crystal Beach stadium during the afternoon.

The 1929 safety committee at the Great Lakes mill, which planned, carried out the successful 1929 campaign and handled all of the details of the celebration was: M. H.

Safety committee at Great Lakes, Buffalo, plant. Upper row, left to right, D. C. Hammond, J. B. Zook, J. O. Moore, J. V. McHugh, C. J. Smith, D. W. Yike, J. A. McGraw. Lower row, G. L. Cluchey, B. McPherson, Miss L. A. Hughes, P. J. Jordan and C. F. Stevenson

The 1928 safety committee at Kingsport: F. Guenther, Jr., general superintendent; R. A. Bechtold, plant superintendent; C. W. Kels, superintendent quarries; C. L. Bunn, office; M. L. Silcox, laboratory; Frank Wright, chief electrician; J. E. Trimble, master mechanic; John Henderson, shift foreman; E. M. Compton, shift foreman; T. L. Keith, repair foreman; E. R. Frey, repairman; T. C. Risk, head burner; John Kiss, foreman yard; Kyle Dishner, foreman shops; Frank Deck, foreman carpenters; Frank Todd, foreman shale quarry; Arthur Dickens, repairman; C. S. Vance, foreman bag house and E. F. Smith, foreman pack house



The dedication ceremonies at the Hercules plant, Stockertown, Penn. President Morris Kind of Hercules Cement Corp. is making the principal address

Hammond, vice-president (deceased); A. T. BeVier, superintendent; J. B. Zook, chief engineer and safety director; J. A. McGraw, yard foreman; Daniel W. Yike, chief chemist; Joseph Moore, repair foreman; C. J. Smith, chief clerk; C. F. Stevenson, pack house foreman; George L. Cluchey, foreman; Dana Hammond, mill foreman; Thomas Huston, mill foreman; Leroy Lutz, mill foreman; Miss L. A. Hughes, nurse; B. McPherson, electrical foreman; P. J. ("Pat") Jordan, machine shop foreman, and J. V. McHugh, clerk.

Hercules Cement Corp. Celebrates

One of the most interesting safety celebrations of the year occurred at the Stockertown (Penn.) plant of the Hercules Cement Corp. on Friday, July 11, when its safety trophy was dedicated and the entire operating and executive forces of the corporation assembled for a picnic supper.

J. Stanley Downs, superintendent, officiated. Rev. Floyd R. Shafer, of Tatamy, Penn., opened the occasion with the invocation after which the trophy was presented and then unveiled by Misses Evelyn Beers and Ann Elizabeth Bruce. The speech of acceptance was made by Marvin Parsons, labor foreman, who was one of the delegates from the plant to the spring meeting of the association.

Morris Kind, president of Hercules, made the principal address in which he traced the growth of the sentiment and active work for the elimination of industrial accidents. Mr. Kind saw the dawn of a new era with cement plants in the forefront among industrial institutions as places in which to work and expressed his congratulations to the men on their accomplishment. Mr. Kind also expressed gratitude to the corporation's employes for the spirit of co-operation shown throughout the organization.

At the close of the ceremony the crowd moved to the Hercules baseball field a short distance away, where a large tent had been erected and flags were flying from every masthead, stay and flyer. Within were long tables set with 700 places. An excellent supper including chicken salad, ice cream and all of the necessary adjuncts, was served, while outside the tent, tanks, bowls and vats of ice cold soft drinks defied the summer temperature.

The celebration was considered the largest of any kind held during recent years in the vicinity of Stockertown. The 1929 safety committee at the Herucles plant included the following: James D. Childress, Ernest M. Ayres, A. H. Bruce, Paul H. Houck, Edgar Rader, Warren G. Breinig, Bruce I. Doyle, Stewart P. Hahn, Marvin Parsons, Wentzel Paukovitch, Samuel Douglas, James F. Schmander, David Easterly, J. Victor Halberstadt, J. Stanley Downs, J. Allen Schaeffer and Charles P. Clauser, Jr.

Four Years Without Mishap Celebrated at Cowell

On the evening of July 4, officials and employes of the Cowell Portland Cement Co. and their families joined in a big celebration at Cowell, Calif., in honor of the completion of over three calendar years and over four years actual time since the last lost-time accident. No workman has lost as much as a single day's pay through injury in the mill or quarry since May 11, 1926.

The exercises connected with re-dedicating the plant's Portland Cement Association trophy, which started at 9 o'clock, were participated in by the entire town, the Cowell school children opening the program by singing "Star Spangled Banner." The principal address of the occasion was made by Hon. C. B. Mickle, a prominent attorney of San Francisco, and the acceptance of the re-award, on behalf of the company and employes, was made by Superintendent E. D. Barnett.

After the ceremones were concluded the mill's annual Fourth of July dancing party got under way in the town hall. The committee on arrangements, consisting of Superintendent Barnett, H. R. Brandenberg, H. G. Brann, B. C. Smith, N. J. Baldwin and A. G. Burg, was conspicuously successful. The floor committee was headed by General Manager W. H. George.

Supper was served continuously from eleven to one o'clock.

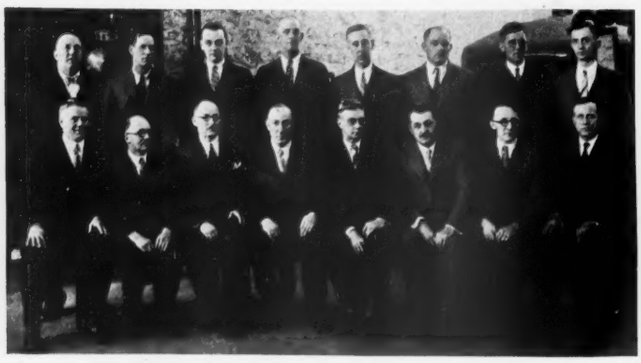
Kingsport Celebrates for Trophy Won in 1928

On July 31, 1930, the Kingsport (Tenn.) mill of the Pennsylvania-Dixie Cement Corp. celebrated the award of its Portland Cement Association trophy for operating throughout 1928 without a lost time accident. As the mill was not producing during the greater part of 1929 the celebration was necessarily delayed until the present season.

John A. Miller of New York, chairman of the board; W. H. Klein, general manager of the Southern division; Morris Fortuin, general manager of the Northern division; A. E. Legg, superintendent of the Richard City plant, and R. A. Bechtold, superintendent of the Des Moines plant, were among the large number of visiting officials.

F. Guenther, Jr., general superintendent of the Kingsport mill and quarries, officiated.

In his speech of acceptance of the trophy, Mr. Guenther spoke gratefully of the spirit of co-operation and loyalty among his men which had made his work a genuine pleasure. Then, displaying a large pile of tele-



These men comprised the safety committee of the Hercules Stockertown, Penn., organization

The general 1929 safety committee of the Lone Star Cement Co., Pennsylvania, Nazareth plant

grams and letters of congratulation he read communications from President Blaine S. Smith; J. B. John, president of the Medusa and Petoskey Portland Cement companies and chairman of the committee on accident prevention of the Portland Cement Association; Col. H. A. Reninger, Lehigh Portland Cement Co., recently president of the National Safety Council, and W. H. Cameron, managing director of the National Safety Council, recognized leader of the industrial safety movement in America.

At the conclusion of the program an informal reception was held on the plant lawn. Refreshments consisting of a variety of sandwiches, soft drinks, ice cream and ices were served, and Mr. Miller, Mr. Klein and other visiting officials extended personal congratulations to the Kingsport employes and their families.

Ash Grove Plant, Nebraska, Has First Safety Rally

EMPLOYES of the Ash Grove Lime and Portland Cement Co., Louisville (Neb.), held their first annual safety rally and picnic July 18 in recognition of having no lost time accidents during the first six months of the year. The program was under the supervision of Superintendent A. K. Frohlish and he was assisted by D. W. Webb, chief engineer; E. C. Alfrey, store room; Harry Whitebread, foreman of the carpenter shop; E. W. Tempelmeyer, chief engineer and head of the safety committee, as well as Fred Brammer of the National Stone Co., Louisville, and Andrew Lundteigen, of the Ash Grove Kansas City office.

After a program of games, a stage show, a demonstration by the first-aid team and some band music the crowd of nearly 700 persons descended on the refreshment table like a cloud of locusts and the excellent chicken sandwiches, ice cream, coffee and pop melted away in a hurry. And after the celebration everyone was able to get away without being bothered by any traffic snarls due to the efficient way in which Theodore Wilcox handled the parking. Prominent guests included Mayor W. S. McGraw, Cecil Pettit, station agent; Dr. E. H. Worthman, Ash Grove company physician; E. Sundstrom, superintendent, Lyman-Richey Sand and Gravel Co. plant at Louisville, and R. H. Hastain, Bank of Commerce.

Safety Meeting Suggestions

"SAFETY MEETINGS" is the title of a booklet issued by the policyholders service bureau of the Metropolitan Life Insurance Co., 1 Madison avenue, New York City. The booklet points out that the greatest reductions in industrial accidents have been made by those organizations which have conducted intensive safety educational programs among all employes. Because of the mass appeal involved, the conduct of employe and foreman safety gatherings has proven to be one of the effective activities on these programs.

As the eighth in a series of reports based upon a study of the field of safety engineering, and designed to present the principles governing successful accident prevention work as well as tested methods of applying these principles, the publication discusses the type of meetings which have been found most effective, together with suggestions for making them interesting and helpful to all concerned.

Cutting and Welding Equipment Increasing Fire Hazard

THE INCREASING number of fires, the cause of which are traceable to the careless use of portable cutting and welding outfits, has caused the National Fire Prevention Association to call attention to certain safeguards necessary in the proper operation of this equipment.

According to C. W. Mowry, manager of the inspection department, Associated Factory Mutual Fire Insurance Cos., the number of such fires has increased from five in 1921 to 70 in 1929 in the plants under his jurisdiction alone. "Of these 70 fires," he says, "only eight were due to the flame of the torch igniting near-by material, and seven were due to abuses of the apparatus, such as broken hose or back-firing of a torch improperly used. The remaining 55 were all due to flying sparks igniting paper, rags, oily waste, excelsior and other loose combustible material, or lodging in cracks in woodwork or falling through holes in floors to rooms below.

"What is needed most is to educate operators regarding better and more adequate precautions. Repair work should always be taken to a safe location if this is possible, but where this is not feasible some comprehensive plan of protection should be followed. It would seem reasonable to require that before portable cutting and welding equipment is used in dangerous locations a permit be obtained from someone in authority who would see that suitable precautions and safeguards were taken. For example, the floor should be swept clean in the vicinity of the work and sprinkled with water if it is a wooden floor. All combustibles should either be moved away a safe distance or protected by adequate asbestos curtains or canvas flame-proofed or spark-proofed.

"Probably the best practicable method of flame-proofing cloth is by treating it with a solution of one part ammonium phosphate to six parts of water, both by weight. The cloth should be thoroughly wet with the solution and then allowed to dry. When so treated the cloth will char when held in a flame, but will not burn or smoulder after the flame is removed. On account of the solubility of ammonium phosphate in water, cloth flame-proofed with this material cannot be used outdoors or cannot be laundered without repeating the treatment.

"In addition to the above-described precautions, the cutting and welding operator should be provided with a liberal supply of first-aid fire equipment, and preferably should have a member of the fire brigade with him. If the building is sprinklered the system should be in service with the valves open. Finally, the scene of the work should be watched for a while after cutting or welding has been completed to look for evidence of smouldering fires. These are all reasonable and practicable safeguards which can be followed in most cases."

In his list of necessary precautions in the use of portable cutting and welding equipment Mr. Mowry includes:

Do not use cutting or welding torches or arcs where an open flame of any kind would be dangerous, as in rooms containing flammable vapors or liquids, lint, dust, or any loose combustible stock. If a torch must be used near dip tanks, the tanks should first be drained, ventilated to remove vapors or provided with tight covers. The apparatus should not be used just outside dipping or spraying rooms, unless there is absolutely no possibility of sparks passing through broken windows, open doorways and cracks or holes in walls or floors.

Cutting or welding work which can be transported should be removed to a safe location in a sprinklered or noncombustible building. If the work cannot be moved, **exposed combustible material should if possible be moved a safe distance away,** say 30 or 40 ft.

Watch the sparks. See that they do not come in contact with combustible material, do not lodge in floor cracks and do not drop through holes to the floor below. Use sheet-metal guards or asbestos curtains where needed. Make sure that the guards and curtains are adequate.

Station extra men with small hose, chemical extinguishers or fire pails near by **when the nature of** the work requires that torches be used near wooden construction or in locations where the combustible material cannot be removed. It is usually well to have a member of the fire brigade supervise the work. Any fire which starts should be promptly extinguished.

Maintain sprinkler protection without interruption while cutting torches are being used. Fire spreads rapidly in unprotected combustible construction, regardless of the cause. During extensive repairs or building changes it is sometimes necessary to shut off the sprinklers. Such lack of protection is a dangerous condition in itself and needs special precautions. The use at such time of an equipment likely to start fire further increases the danger and is decidedly unwise. The remedy is to plan the work so that cutting or welding and sprinkler repairs are done at different times. It is only in rare cases that this will not be possible, and then the insurance company should be consulted in advance, to outline special precautions shown by experience to be necessary.

Keep a man at the scene of the work for a half hour after completion to make sure that sparks have not started smouldering fires.

Keep the equipment in good order. Use good hose and renew it when necessary. See that hose connections are tight and not worn. Modern, approved apparatus, well maintained, should give little trouble.

Mount the cylinders securely on a truck so arranged that the valves, regulators and other fragile parts are well guarded.

Store extra cylinders outside important area. Oxygen and hydrogen acetylene released from tanks would greatly intensify any fire which might break out.

Cement Price-Cutting in Northwest

WITH REFERENCE to the financial status of the portland cement industry on the Northwest Pacific Coast, the Pacific Coast Edition of the *Wall Street News* recently said: "Well-informed circles in Seattle are looking toward an early settlement of the cement price-cutting which has been continuing with slight interuption since February of this year. During 1929 a desultory skirmish ensued for a period of five weeks, but was ended when a leading company posted a public price schedule. It is considered probable that the current price-cutting will end with a similar gesture. It is also quite likely that active reflection of such developments will be shown in such issues as Superior Portland Cement, inasmuch as that particular company by virtue of being a particularly low cost producer is in an excellent position to benefit immediately by any price betterment."

Construction Industry's Outlook Fair

FOR THE FIRST TIME since 1927 the volume of construction performed during July, as indicated by last month's shipments of basic construction materials, exceeded that of June, showing a gain of 8 points to Index Number 199, according to a statistical analysis just completed by the Associated General Contractors of America.

The July, 1930, volume, however, was 8 3/5% below that for the corresponding month last year, while the composite index number for the first seven months was 20 points, or 11 3/7% below the comparative index number of 175 for 1929.

In commenting on the analysis, Edward J. Harding, assistant general manager of the association, pointed out that the July volume more closely approximated that of the corresponding month last year than has that of any month of the current year since March. A continuation of this trend during the next four months, he said, could very nearly offset the decrease of 12% in construction volume reported for the first half of the year.

The association's analysis shows that long term state and municipal bond issues, as reported by *The Bond Buyer*, averaged $125,000,000 a month during the first half of the year as compared with $116,800,000 per month for the corresponding period of 1929, and that concrete surface pavement awards totaled 82,821,000 square yards, or an increase of 13% as compared with 1929.

The average of construction costs in the principal construction centers in July was 3 points less than the cost index figure for the same month a year ago, standing at index number 199, the association reports.

Chicago Rock Products Prices

PRICES of sand, gravel, crushed stone, lime, cement, etc., have been reported as abnormally low in Chicago for many months. Recently the principal dealers (who are also producers of all these commodities except cement) announced slightly increased new prices, at the same time publicly explaining that the old prices were ruinous. The new prices are not very profitable if one considers they are "delivered on the job" prices. They are:

Portland cement, in cloth, per bbl., $2.25; portland cement, in paper, per bbl., $2.10.

Crushed stone per cu. yd., $2. Screenings, per cu. yd., $1.65. Crushed or roofing gravel, per cu. yd., $2.

Torpedo sand, No. 1, per cu. yd., $2.25; torpedo sand, No. 2, per cu. yd., $2; white sand, bulk, load lots, $8.50. White sand, paper bags, load lots, per ton, $9.50; lake and bank sand, per cu. yd., $2.

Wisconsin bulk lime, per bbl., $1.50; Wisconsin lime, in wood, per bbl., $2.60; Wisconsin hydrated, in paper, per ton, $16; plasterers' hydrated, per ton, $17.

Retail Prices of Various Rock Products Materials

THE TABLE below gives average prices paid July 1, 1930, by contractors for various rock products, delivered on the job at different principal cities of the United States. These prices were secured through the Bureau of Census.

Changes noted from last report are:

Portland cement. Haverhill, up 10c; Tampa, down 20c; Toledo, down 75c; Chicago, up 20c, and Seattle, up 40c.

Gypsum wallboard. No change in range. New cities quoting are Paterson, Winston-Salem, Shreveport, Akron, Youngstown and Chicago.

Lime. Trenton, up $4.00; Baltimore, up 50c; Tampa, down $2.00; Youngstown, down $2.00; Chicago, up $3.50, and San Francisco down $2.50. New cities reporting are New Haven, Syracuse, Columbia, Toledo and Kansas City.

Building sand. Buffalo, $2.50 to $1.85; Paterson $1.75 to $1.50; Baltimore, $2.00 to $2.25; Toledo, $2.25 to $2.00; Chicago, $1.95 to $1.50; Milwaukee, $2.00 to $1.75; Kansas City, $1.88 to $2.70; St. Louis, $2.09 to $2.23, and Seattle, $1.40 to $1.25.

Crushed stone. Haverhill, $4.00 to $3.20; Syracuse, $2.00 to $2.25; Paterson, $1.90 to $2.10; Tampa, $4.00 to $4.25; Toledo, $2.75 to $2.50; Chicago, $2.00 to $1.90; Milwaukee, $2.00 to $1.75; Kansas City, $1.80 to $2.25; St. Louis, $1.50 to $1.75, and Tucson, $2.00 to $2.25.

Gypsum plaster. Baltimore, $16.00 to $14.50; Winston-Salem, $16.00 to $17.00; Columbia, $17.50 to $17.00; Tampa, $20.00 to $18.00; Toledo, $15.00 to $14.00; Tucson, $17.50 to $17.10, and San Francisco, $18.50 to $16.90. New cities listed are Youngstown and Chicago.

Additional cities incorporated into this general report are Birmingham and New Orleans. Cities not reporting are Detroit, Grand Forks and Denver.

AVERAGE RETAIL PRICES FOR ROCK PRODUCTS MATERIALS, JULY 1, 1930

City	MATERIAL					
	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.90	.....	$25.00	$1.50	$2.25	.....
New London, Conn.	2.80	$25.00	26.00	1.50	3.00	$18.00
Waterbury, Conn.	3.00	30.00	20.00	1.35	2.45	20.00
Haverhill, Mass.	2.80	25.00	20.00	.....	3.20	18.50
New Bedford, Mass.	2.60	25.00	18.50	1.75	3.00	17.50
Albany, N. Y.	2.97	24.75	18.00	.....	.....	17.10
Buffalo, N. Y.	3.10	25.00	18.00	1.85	2.05	14.00
Poughkeepsie, N. Y.	2.04	.....	.....	2.25	2.20	.....
Rochester, N. Y.	3.25	22.00	22.00	2.00	2.40	17.00
Syracuse, N. Y.	3.00	22.50	18.00	2.00	2.25	17.00
Paterson, N. J.	2.60	25.00	18.00	1.50	2.10	16.00
Trenton, N. J.	2.40	26.00	18.00	1.50	2.10	17.50
Philadelphia, Penn.	2.30	.....	15.50	1.85	2.65	19.75
Scranton, Penn.	2.80	.....	20.00	3.25	.....	19.00
Baltimore, Md.	2.40	.....	13.50	2.25	2.75	14.50
Washington, D. C.	2.65	25.00	14.00	.....	.....	17.00
Richmond, Va.	3.10	31.00	17.50	1.95	2.45	20.00
Fairmount, W. Va.	2.80	35.00	16.00	3.15	3.50	18.00
Winston-Salem, N. C.	2.80	23.50	14.00	1.50	3.50	17.00
Columbia, S. C.	2.90	.....	18.00	1.25	2.50	17.00
Atlanta, Ga.	3.25	.....	21.00	2.50	3.25	20.00
Savannah, Ga.	2.25	25.00	20.00	1.75	5.50	16.00
Tampa, Fla.	2.40	.....	18.00	2.00	4.25	18.00
New Orleans, La.	2.65	.....	16.00	2.75	3.00	20.00
Shreveport, La.	3.60	39.00	.....	2.00	4.75	22.00

City	MATERIAL					
	Portland cement, per bbl. exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
Birmingham, Ala.	$3.00	.....	$20.00	$3.00	$2.50	$17.00
Erie, Penn.	2.40	$22.50	19.00	2.25	.....	16.00
Akron, Ohio	2.67	36.00	18.00	1.85	.....	.....
Cincinnati, Ohio	2.94	24.75	16.40	2.63	2.55	.....
Cleveland, Ohio	2.80	.....	16.00	1.95	2.70	15.50
Columbus, Ohio	2.75	23.00	17.50	2.25	2.50	15.00
Toledo, Ohio	2.25	22.50	12.00	2.00	2.50	14.00
Youngstown, Ohio	2.95	40.00	18.00	3.71	2.75	15.00
Lansing, Mich.	2.75	.....	22.00	2.25	2.25	16.00
Saginaw, Mich.	2.40	25.00	18.00	2.50	3.25	17.00
Terre Haute, Ind.	3.00	28.00	18.00	1.65	3.50	20.00
Louisville, Ky.	2.52	.....	15.50	.....	2.43	16.00
Chicago, Ill.	2.20	21.00	17.00	1.50	1.90	15.00
Milwaukee, Wis.	2.60	25.00	16.00	1.75	1.75	18.00
Des Moines, Iowa	2.66	23.75	20.00	1.60	3.60	10.00
Kansas City, Mo.	2.50	25.00	19.00	2.70	2.25	15.00
St. Louis, Mo.	2.45	.....	18.00	2.23	1.75	18.00
St. Paul, Minn.	2.75	21.00	21.00	1.40	2.00	16.00
Sioux Falls, S. D.	3.00	.....	24.00	1.25	2.25	15.00
San Antonio, Texas	2.60	37.00	20.00	2.10	2.35	18.15
Tucson, Ariz.	3.17	.....	30.00	1.25	2.25	17.10
Long Beach, Calif.	1.76	34.00	26.00	1.95	2.20	17.50
Los Angeles, Calif.	1.72	34.00	24.00	1.00	1.30	17.50
San Francisco, Calif.	2.42	.....	20.00	1.40	1.60	16.90
Seattle, Wash.	1.90	35.00	22.00	1.25	.....	20.00

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Trend in Designs on Cement Products

Part III—Various Classifications of Designs Which Govern Ornamentation

By George Rice
Palo Alto, Calif.

ALL ORNAMENTATION can be classified as either geometric, naturalistic or conventional, whether it be applied to a soft material like a fabric, or to a hard material like cement. Ornamentation of the geometric class consists of an arrangement of circles, squares, spirals, oblongs, sometimes with intersecting lines and various forms of other figures and then again without these latter embellishments.

The naturalistic form of art involves that which is based chiefly upon natural objects, especially those chosen from flowers and leaves or bird life. Sometimes these are appropriately colored for art plaques and other architectural cement objects, and then again they are produced in relief and left in the natural color of the cement.

The conventional type of ornamentation is also based to some extent upon observation of what we see in nature, but instead of the natural forms of flowers or birds being copied direct into the scheme of the design they are conventionalized. That is, they are chosen, set apart, simplified or rendered even more intricate than before, and adapted to the decorative plan in hand.

The verdure style of cement decoration, in which forms of fruit and leaves are treated in a near-conventional way, are among some of the masterpieces of the time. Then there are the period designs which some refer to as the archaeological class of cement ornamentation. These, of course, are based upon the type of ornamentation used by the ancient artisans in stone of old Egypt, Chaldea and Assyria.

Fig. 2. Something from bird or animal life is inserted

The futurist, cubist and vorticist movements of recent times have not been able to change the character of these period-study designs very much, and they still retain their ancient marks. There are many pieces of richly designed cement products which come under the heading of strictly modern and which, upon examination by one who is not even an expert, will prove to have been built upon with some period

Fig. 1. The frame of the contemplated design is first drawn on paper

stuff in the ground and perhaps in the floral or other effect in the pattern.

The Naturalistic Design Is Used on the Proper Construction of the Frame, Like All Other Designs

Cement designing is a branch of applied art which requires technical knowledge as well as artistic ability. But tastes and knowledge of the inclinations of the public are very helpful. We know of a designer of cement tile who wanders over river beds, through woods, and about the rocks for suggestions for his designs. He finds disintegrated granites and rocky formations containing numerous suggestions for design building. As he wades upstream his eye catches a formation in a sand bank, presenting attractive color tones, and he gathers some of the sand and in his laboratory makes a dialysis of its particles to reproduce the effect in a naturalistic design which he is working on.

He scours the meadows, the moors and the hillsides and comes back with a bag filled with selected leaves, stems, buds and petals. Samples of grasses, mosses and barks are included in his gatherings and he makes use of them all when formulating a design in cement based on nature. He has technical knowledge and artistic ability and what he gets from the sand dunes or from up the creek or in the pastures is scientifically arranged in his decorative creations. A frame work is first started, on the same principle that a frame is first outlined for any proposed design. Assuming that the design will be one of a naturalistic order, because of the presence of something taken from plant or bird life within its area of ornamentation, the frame can be constructed after the fashion of that shown in Fig. 1. The units can be shifted about in accordance with the ideas of the artist, or the requirements of the person or persons for whom the design is executed.

Then the parts which are to give the design the naturalistic touch are inserted, which in this case are birds, as shown in Fig. 2. Or, instead of something from bird life, objects from plant life may be used, in which case a different arrangement of the frame setting would be necessary to accommodate whatever forms of plants, flowers, leaves, buds or petals are to be used. Motifs similar to those shown in Fig. 3 might be decided upon, or perhaps roses, or just plain vines would suffice.

Nature itself is very harmonious, not

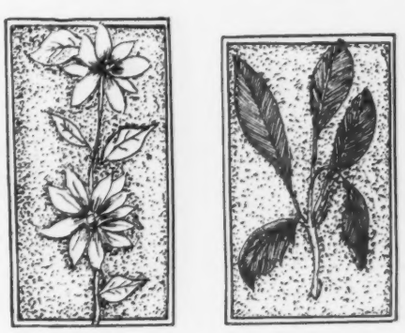


Fig. 3. Motifs taken from plant life also are chosen

only in its forms of the flowers and vines, but in the colors. So if nature is followed in the blending of the parts and modeling of the coloring schemes, the designer is not likely to go very far amiss.

Designs Which Are Striking in Character Sell the Best

According to the information which we obtained from a dealer who is in position to know the general trend in designs on cement articles, those designs which are striking in character sell the wares better than those designs which do not have this feature plain enough for normal visibility. This information about the designs is true for two reasons. First, the cement object which has a striking design on its face is more adaptable to home, office, store, salon, garden and general architectural decorations than almost any other kind.

This is because almost everywhere that cement tile, plaques, pottery, stands, garden table tops, flower boxes and the general line of decorative cement objects are used, the environments are highly decorative. Store windows are so richly trimmed with beautifully colored articles of merchandise that it is absolutely necessary that the designs in the tile fronts of these windows be striking.

Second, it is commercially safer for the dealer to have cement objects in stock on which the designs are of a striking character, for he can sell them more readily than some of the other types, although the latter may be more meritorious from the point of view of a real artist.

Designs of a geometric order will be considered next.

Making Use of Concrete in the Garden

F. H. Colman
Los Angeles, Calif.

CALIFORNIA ARCHITECTS are finding new uses for concrete, not only in the building itself, but in the garden, as well. An interesting garden is that of C. C. Reed of Orange, Calif., where a number of novel uses for concrete have been found.

The Reed garden was level and as it was the desire to enjoy a hillside garden, a double garage was built in the form of a tunnel using reinforced concrete for the walls and the roof.

On either side of the garage door Mr. Reed had a local craftsman in concrete do a concrete wall in imitation of stone. A dirt fill was then put over the garage, making it into a miniature hill.

A series of stone steps and a rustic fence, all cleverly molded from concrete, marks the way to the top of the hill where a barrel cactus made from concrete mingles surprisingly well with the real cactus growing in the garden on top of the garage.

The garden is dominated with a life-sized black bear made in concrete. At the foot of this miniature hill there is a replica of a famous old olive mill used by the early mission fathers and made entirely from concrete.

In the side yard there is an old fashioned well with its stone walls made from concrete and, beside it, a concrete sundial cleverly imitating a sawed off tree.

Concrete has also been used in making small rustic log bridges. To complete the picture this little garden is illuminated with a floodlight concealed in a tiny Indian tepee made from concrete that not only hides the source of light but is in itself an appropriate garden ornament.

Des Moines Sand and Gravel Producer Builds Ready-Mix Plant

JOHN F. KEEFNER, president of the Hawkeye Sand and Gravel Co., and the Des Moines Building Material Co., Des Moines, Iowa, has extended his operations to include the new Keefner Concrete Co., which has recently completed one of the largest ready-mixed concrete plants in the Middle West. Joe Keefner is vice-president of the new company and Albert Petersen, secretary.

According to the *Des Moines Tribune-Capital:*

The plant has a capacity of 600 cu. yd. of concrete a day, with a storage capacity of more than 100 carloads of sand and gravel. Its installation in Des Moines was made to keep pace with the new and more exacting requirements for concrete construction work, in which sand, gravel, cement and other ingredients must now be accurately weighed, instead of being handled merely by bulk as in the past, Mr. Keefer said, and in anticipation of the continued rapid building development of the city.

While this is the only plant of its kind in Iowa, similar plants have been in operation in large eastern cities for some time and have recently been installed in Minneapolis, Omaha, St. Paul and Kansas City.

Prof. W. A. Donagan of the materials laboratory at Iowa State College, Ames, will act as consulting engineer of the plant, and the Patzig laboratory, of Des Moines, will have charge of inspection.

The equipment will be operated by electricity, and will produce all grades of concrete—from the fine "mix" used for finishing work to heavy concrete for buildings and pavement.

The plant is 70 ft. high. Cement is hauled to it in bulk, directly from cement plants here, and sand and gravel are elevated by special conveyors to four large hoppers at the top. Each hopper has a capacity of more than a carload. A similar container for water is also situated at the top of the main equipment, so that all operations may be carried on with minimum handling.

The plant is equipped with flood lights, so that it can be operated both day and night when necessary. The first large job, on which the company began supplying material was the new Grocers Wholesale Building.

Officials of the company were planning to hold "open house" to the public and a formal opening with architects, contractors, and cement officials in attendance.

Reversing Screw Conveyor Flow

A BELT driven screw conveyor can be made to deliver material in either direction by simply crossing the belt.

Using concrete to enhance the beauty of the garden. Left, the well of concrete, and the sundial mounted on a simulated stump of a tree. Center, the garage. At right, small concrete tepees conceal floodlights

Sand-Lime Brick Production and Shipments in July

NINETEEN plants reporting for July bring figures that would indicate production ran about the same for July as in June. One plant reported that it was shut down. The figures for shipments by rail include those by truck for one manufacturer who lumped his total shipments into the by rail column. Stocks show an increase although unfilled orders also are greater than for the previous month. The fact that some five plants reported blank for unfilled orders may indicate that figure should be higher. Two plants reported "none" for unfilled orders.

Two new cities are represented in the quotations for July and the general trend of prices remains even. Boston prices went up a half a dollar while Atlantic City, Detroit, Iona and Winchester show slight reductions.

The following data are compiled from reports received direct from 20 producers of sand-lime brick located in various parts of the United States and Canada. The number of plants reporting is one more than those furnishing statistics for the June estimate, published in the July 19 issue. The statistics below may be regarded as representative of the entire industry in the United States and Canada.

Following are average prices quoted for sand-lime brick in July:

Shipping point	Plant price	Delivered
Atlantic City, N. J.	$12.00	$16.00@17.00
Boston, Mass.	11.00	15.00
Dayton, Ohio	12.50	15.00
Detroit, Mich.	.....	15.50@16.00
Detroit, Mich.	.....	15.50
Detroit, Mich.	13.00	15.50
Grand Rapids, Mich.	14.00	.....
Iona, N. J.	11.00	14.50
Jackson, Mich.	13.00	.....
Menominee, Mich.	11.00	13.50
Pontiac, Mich.	12.50	15.50
Milwaukee, Wis.	10.50	13.00
Mishawaka, Ind.	11.00	.....
Saginaw, Mich.	12.00	.....
Syracuse, N. Y.	18.00	20.00
Toronto, Can.	11.00	13.00
Winchester, Mass.	.....	14.50

The following statistics are compiled from data received direct from 20 producers of sand-lime brick in the United States and Canada:

Statistics for June and July

	†June	*July
Production	10,316,785	10,414,915
Shipments (rail)	2,929,465	3,101,586
Shipments (truck)	6,809,232	6,780,737
Stocks	13,191,419	14,328,287
Unfilled orders	9,314,000	9,796,500

*Twenty plants reporting: incomplete, one not reporting stocks on hand, and five not reporting unfilled orders; two not reporting truck shipments and seven, no rail shipments.

† Nineteen plants reporting; incomplete, one plant not reporting stocks on hand. Five not reporting unfilled orders. One plant reports "shut down."

Notes from Producers

The Iona Brick Co., Iona, N. J., reports that it has secured the contract for furnishing brick for seven school house projects in its territory and that work is progressing on this order at the present time.

That the Walker and Frank Brick Co., Detroit, Mich., will concentrate on sand-lime brick is indicated in the approaching exhaustion of its rich clay beds in the west Detroit section. The company's beds are now being excavated to the depth of 30 ft. and it is reported that material is available for approximately four more years of production of clay brick.

The Crume Brick Co., Dayton, Ohio, has opened pretentious new quarters, consisting of general and sales offices and display rooms, on the first floor of the Dayton Industries building, northwest corner of Third and Ludlow streets, according to an announcement received from William H. Crume, president and general manager.

The new central location with a large parking space adjacent, will make it convenient for Crume customers to call and inspect the various lines of common and face brick and concrete products in tile, brick, standard and Haydite units.

New Silica Brick Plant for Ohio

JACKSON (Ohio) is to have a new industry which will be capitalized at $250,000. It will be for the manufacture of silica brick.

For several years, the *Jackson Herald* says, certain Jackson people have been making a careful study of the county's resources in co-operation with Wilbur Stout, state geologist. It is said that the county abounds in a silica which is considered the highest quality material for fire brick. Silica bricks are especially used as furnace lining, and there are only a few plants in the country making this kind of brick.

National Conference of Construction to Be Created as Permanent Agency

CREATION of a permanent national conference on construction for the purpose of bringing the various activities of the building industry, both in the private and public fields, under one agency has been decided upon, it has just been announced, August 8, by the National Building Survey Conference, organized at the instance of President Hoover.

The conference, while it has not yet decided upon a particular program, will begin to function some time between September 15 and October 15. It will have the combined assistance of the Department of Commerce and the United States Chamber of Commerce in the pursuance of several studies it plans to make concerning various phases of construction problems. The announcement says:

As a vehicle for bringing activities of the various branches of the construction industry and allied agencies to focus upon common problems, the creation of a permanent National Conference on Construction was decided upon at an informal meeting of representatives of the trades held in Chicago recently under the chairmanship of Julius H. Barnes, chairman of the National Business Survey Conference.

The meeting reviewed the principal intergroup problems of the construction industry and the possibility of developing a continuing organization to assist in the solution of them. It discussed aspects of realty finance, property appraisal, methods of home financing, credit practices and other questions involved in the greater stabilization.

At the conclusion it authorized a committee, headed by Mr. Barnes, to make the necessary arrangement for the setting up of the conference the purposes of which were defined as reviewing the outstanding common problems of the business and other interests identified with construction, arranging a program of activities including factual studies, and formulating recommendations to be made to the co-operating agencies.

The reports indicate that all counties had an estimated total of $953,529,592 in available funds, consisting of an unexpended balance of $163,401,207 carried over from the previous year, and a total income of $790,128,385. To the total income, the motor vehicle license fees and gasoline tax receipts allotted to the counties, $51,886,324 and $70,492,878, respectively, contributed 15%; receipts from local bond sales, amounting to $110,635,146, supplied 14%; and the total road tax of $414,152,567 contributed 52%. Appropriations from county general funds for use in road work amounted to $75,018,526; transfer of funds from state to counties for local road work amounted to $31,714,578.

Seek to Prevent Dredging

PAUL GROUT, attorney for the village of Asharoken, Long Island, N. Y., has served papers on the Metropolitan Sand and Gravel Co., it was announced recently, enjoining it from going ahead with its operations on the former Hall property, which the company purchased last year for $1,000,000. The papers were served on the company seven hours after the town board had adopted the new zoning ordinance.

This is the first case under the new zoning ordinance and the matter will be taken to the courts by the Metropolitan company. Alexander Miller, attorney, of Huntington Station, who strenuously opposed the zoning map and ordinance as presented to the town board by Chairman Meyer of the Zoning Commission, has been retained by the Metropolitan Sand and Gravel Co. and will contest the writ served on his company. The Metropolitan concern had dredges, scows and other craft in the vicinity of its property recently, and it was said the staff of the Long Island Lighting Co. had been working for two weeks putting in wire preparatory to the commencement of operations.—*New York* (City) *Times.*

The Rock Products Market

Wholesale Prices of Sand and Gravel

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ¼ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Asbury Park, N. J.		.65	1.25	1.25	1.15	1.15
Attica and Franklinville, N. Y. (a)	.75	.75	.75	.75	.75	.75
Boston, Mass.‡	1.25	1.15	1.75		1.75	1.75
Buffalo, N. Y.	1.10	1.05	1.05	1.05	1.05	1.05
Erie, Penn.	.70	.90	1.25	1.25		
Leeds Jct., Me., and Milton, N. H.		.50	1.75	1.75	1.25	1.00
Machias Junction, N. Y.	.65	.65	.65		.65	.65
Montoursville, Penn.	1.00	.70	.50	.50	.40	.40
Northern New Jersey	.30–.50	.30–.50	.90–1.25		.90–1.25	
Scarboro, Me.		1.00	2.25	2.25	2.00	2.00
Washington, D. C.	.60	.60	1.00	1.00	1.00	1.00
CENTRAL:						
Algonquin, Ill.	.30	.15	.20	.30	.35	.35
Attica, Ind.			All sizes .75–.85			
Barton, Wis.		.40	.50	.60	.60	.60
Cincinnati, Ohio	.55	.55	.80	.80	.80	.80
Crystal Lake, Ill.	.30	.15	.25	.30	.30	.40
Des Moines, Iowa	.30–.60	.30–.60	1.50–1.65	1.50–1.65	1.50–1.65	1.50–1.65
Dresden, Ohio		.60	.70–.80	.75	.75	.70
Eau Claire, Wis.		.40	.55	.85	.85	
Elkhart Lake and Glenbeulah, Wis.	.50	.40	.40	.50	.40	.50
Grand Rapids, Mich.		.50		.80	.80	.70
Greenville, Ohio	.50–.70	.40–.60	.50–.60	.50–.60	.50–.60	.50–.60
Hamilton, Ohio	.65–.75	.65–.75	.65–.75	.65–.75	.65–.75	.65–.75
Hersey, Mich.		.50		.60	.60	.70
Indianapolis, Ind.	.50–.60	.25–.60	.40–.60	.45–.75	.45–.75	.45–.75
Kalamazoo, Mich.		.40–.50		.45–.55		.50–.75
Kansas City, Mo.	.70	.70		.80		
Mankato, Minn.	.55	.45	1.25	1.25	1.25	
Mason City, Iowa		.50		1.25	1.25	1.25
Milwaukee, Wis.		.86	.86	.96	.96	.96
Minneapolis, Minn.	.35	.35	1.25	1.35	1.35	1.25
Oxford, Mich.	.25–.35	.20–.30	.30–.40	.55–.75	.55–.75	.60–.75
St. Paul, Minn.	.35	.35	1.25	1.25	1.25	1.25
Terre Haute, Ind.	.75	.75	.75	.75	.75	.75
Urbana, Ohio	.65	.55	.65	.65	.65	.65
Waukesha, Wis.		.45	.60	.60	.65	.65
Winona, Minn.	.40	.40	.50	1.10	1.00	1.00
SOUTHERN:						
Brewster, Fla.	.40–.50					
Charleston, W. Va.	.70	1.25	1.25			
Eustis, Fla.		.40–.50				
Fort Worth, Texas	.75	.75	1.00	1.00	1.00	1.00
Knoxville, Tenn.	.75	1.00	1.20	1.20	1.20	1.20
Roseland, La.	.25	.25	1.00	.70	.60	
WESTERN:						
Oregon City, Ore.			Sand for concrete, 1.00-1.50 per cu. yd. at plant			
Phoenix, Ariz.		1.25*	1.15*	1.50*	1.15*	1.15* 1.00*
Pueblo, Colo.		.80	.60		1.20	1.15
San Gabriel and San Fernando Valleys, Calif.		.60	.60	1.10	1.10	1.10 1.10
Seattle, Wash.		1.00*	1.00*	1.00*	1.00*	1.00* 1.25*

*Cu. yd. ‡Delivered on job by truck. (a) Prices on trucks; on cars, 65c per ton for all sizes.

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; per ton f.o.b. plant.

City or shipping point	Molding, fine	Molding, coarse	Molding brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	2.00	2.00	2.25			.400	
Cedarville, N. J.			Washed, 1.75 net ton: dried and washed, 2.25 net ton				
Cheshire, Mass.			Sand for soap, 5.75–7.00			5.00	
Columbus, Ohio	1.50	1.50	1.35	.90		3.50–4.50	
Dresden, Ohio	1.15–1.50	1.00–1.35	1.25–1.50	1.00–1.25	1.25		
Eau Claire, Wis.						2.50–3.00	
Elco, Ill.			Soft amorphous silica, 92%–99% thru 325 mesh, 18.00–40.00 per ton				
Kasota, Minn.							1.00
Montoursville, Penn.				1.25–1.50			
New Lexington, Ohio	2.00	1.25					
Ohlton, Ohio	1.75*	1.75*		2.00*	1.75*	1.75*	
Ottawa, Ill.	1.25–3.25	2.25–3.50	1.25–3.25	1.25–3.25	1.25	3.50	3.50
Red Wing, Minn. (a)					1.50	3.00	1.50
San Francisco, Calif.	3.50†	5.00†	3.50†	2.50–3.50†	5.00†	3.50–5.00†	

†Fresh water washed, steam dried. *Damp. (a) Filter sand, 3.00.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Dresden, Ohio		1.00
Eau Claire, Wis.	4.30	1.00
Montoursville, Penn.		1.00
Ohlton, Ohio	1.75	1.75
Ottawa, Ill.	1.25–3.25	1.25
Red Wing, Minn.		1.00
San Francisco, Calif.	3.50	3.50
Silica, Va.		1.75

Glass Sand

(Silica sand is quoted washed, dried and screened)

Cheshire, Mass. (in carload lots)	5.00
Klondike, Mo.	2.00
Ohlton, Ohio	2.50
Ottawa, Ill.	1.25
Red Wing, Minn.	1.50
San Francisco, Calif.	4.00–5.00
Silica and Mendota, Va.	2.50–3.00

Bank Run Sand and Gravel

Algonquin, Ill.¶ (½-in. and less)	.25
Buffalo, N. Y.—Sand, 1/10-in. down, 1.00; ¼-in. down, .75; gravel, all sizes	.75
Burnside, Conn. (sand, ¼-in. and less)	.75*
Crystal Lake, Ill.¶ (½-in. and less)	.25
Fort Worth, Tex.¶ (2-in. and less)	.65
Gainesville, Tex.¶ (1½-in. and less)	.55
Gary and Miller, Ind.†	1.15–1.40a
Grand Rapids, Mich.¶ (1-in. and less.)	.55
Hamilton, Ohio¶ (1½-in. and less)	.50–1.00
Hersey, Mich.¶ (1-in. and less)	.50
Mankato, Minn.†	.70
Oregon City, Ore.—River run	1.00–1.50
Winona, Minn.†	.60
York, Penn.—Sand, 1/10-in. down, 1.10; ¼-in. and less	1.00

*Cubic yard. †Fine sand, 1/-10-in. down. (a) Cu. yd., delivered Chicago. ¶Gravel.

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations.

Portland Cement

	F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.....	3.70	4.30¶
Atlanta, Ga.	.....	2.19†	3.49¶
Baltimore, Md.	.....	2.26*	3.56¶
Berkeley, Calif.	.....	2.14	.....
Birmingham, Ala.	.....	1.85†	3.15¶
Boston, Mass.	.47	1.88†	3.27¶
Buffalo, N. Y.	.61¼	2.05†	3.35¶
Butte, Mont.	.90¼	3.61	.....
Cedar Rapids, Ia.	.....	2.23*	.....
Centerville, Calif.	.....	2.14	.....
Charleston, S. C.	.....	a2.29†	3.26¶
Cheyenne, Wyo.	.....	2.86	.....
Chicago, Ill.	.....	1.95*	3.25¶
Cincinnati, Ohio	.....	2.14*	3.44¶
Cleveland, Ohio	.....	2.04*	3.34¶
Columbus, Ohio	.....	2.12†	3.47¶
Dallas, Texas	.....	†1.90	3.49¶
Davenport, Iowa	.....	2.14*	.....
Dayton, Ohio	.....	2.14†	3.44¶
Denver, Colo.	.66¼	2.65	.....
Des Moines, Iowa	.48½	1.94	.....
Detroit, Mich.	.....	1.95*	3.25¶
Duluth, Minn.	.....	2.04*	.....
Fresno, Calif.	.....	2.33	.....
Houston, Texas	.....	†2.00	3.73¶
Indianapolis, Ind.	.54¼	1.99*	3.29¶
Jackson, Miss.	.....	2.29†	3.59¶
Jacksonville, Fla.	.....	b2.34†	3.26¶
Jersey City, N. J.	.....	2.13†	3.43¶
Kansas City, Mo.	.50½	2.02	3.22¶
Los Angeles, Calif.	.57½	2.30	.....
Louisville, Ky.	.55½	2.12–2.15†	3.42¶
Memphis, Tenn.	.....	2.29†	3.59¶
Merced, Calif.	.....	2.01	.....
Milwaukee, Wis.	.....	2.10*	3.40¶
Minneapolis, Minn.	.....	2.27*	.....
Montreal, Que.	.....	1.60‖	
New Orleans, La.	.43	1.92†	3.22¶
New York, N. Y.	.50¾	2.03*	3.33¶
Norfolk, Va.	.....	1.97†	3.27¶
Oklahoma City, Okla.	.61½	2.46	3.66¶
Omaha, Neb.	.59	2.36	3.56¶
Peoria, Ill.	.....	2.12*	3.32¶
Pittsburgh, Penn.	.....	1.95*	3.25¶
Philadelphia, Penn.	.....	2.15*	3.45¶
Phoenix, Ariz.	.....	3.51	.....
Portland, Ore.	.....	2.50‡	.....
Reno, Nev.	.....	2.76‡	.....
Richmond, Va.	.....	2.32†	3.62¶
Sacramento, Calif.	.....	2.25	.....
Salt Lake City, Utah	.70¼	2.81	.....
San Antonio, Texas	.....	.....	3.42¶
San Francisco, Calif.	.....	2.24‡	.....
Santa Cruz, Calif.	.....	2.10	.....
Savannah, Ga.	.....	a2.29†	3.16¶
St. Louis, Mo.	.48¾	1.95†	3.25¶
St. Paul, Minn.	.....	2.27*	.....
Seattle, Wash.	.....	1.75	†2.50c
Tampa, Fla.	.....	2.00†	3.41¶
Toledo, Ohio	.....	2.20*	3.50¶
Topeka, Kan.	.55¼	2.21	3.41¶
Tulsa, Okla.	.58¼	2.33	3.53¶
Wheeling, W. Va.	.....	2.02†	3.32¶
Winston-Salem, N. C.	.....	2.44†	3.54¶
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Albany, N. Y.	.....	2.15	.....
Bellingham, Wash.	.....	2.25	.....
Bonner Springs, Kan.	.....	1.85	.....
Buffington, Ind.	.....	1.70	.....
Concrete, Wash.	.....	2.65	.....
Davenport, Calif.	.....	2.05	.....
Hannibal, Mo.	.....	1.80	.....
Hudson, N. Y.	.....	1.85	.....
Independence, Kan.	.....	1.85	.....
Leeds, Ala.	.....	1.70	.....
Limedale, Ind.	.....	1.70	.....
Lime & Oswego, Ore.	.....	2.50	.....
Nazareth, Penn.	.....	2.15	.....
Northampton, Penn.	.....	1.75	.....
Richard City, Tenn.	.....	2.05	.....
Steelton, Minn.	.....	1.85	.....
Toledo, Ohio	.....	2.20	.....
Universal, Penn.	.....	1.70	.....
Waco, Tex.	.....	1.85	.....

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. *Includes dealer and cash discounts. †Includes 10c cash discount. ‡Subject to 2% cash discount. (a) 44c refund for paid freight bill. (b) 38c bbl. refund for paid freight bill. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. ‖Includes sales tax. (c) Quick-hardening "Velo."

Wholesale Prices of Crushed Stone

Prices given are per ton, F.O.B., producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	1.25	1.25	1.25	1.25	1.25	1.25
Chazy, N. Y.	.75	1.60	1.60	1.30	1.30	1.30
Farmington, Conn.	.60	1.30	1.30	1.00	1.00	.....
Ft. Spring, W. Va.	.35	1.35	1.35	1.25	1.15	1.00
Jamesville, N. Y.	1.00	1.00	1.00	1.00	1.00	.....
Oriskany Falls, N. Y.	.50–1.00	1.00–1.35	1.00–1.35	1.00–1.35	1.00–1.35	1.00–1.35
Prospect Junction, N. Y.	.50– .80	.....	1.00–1.15	1.00–1.10	1.00–1.10	.....
Rochester, N. Y.—Dolomite	1.50	1.50	1.50	1.50	1.50	1.50
Hillsville, Penn.	.85	1.35	1.35	1.35	1.35	1.35
Shaw's Junction, Penn. (e)	.85	1.20–1.35	1.20–1.35	1.20–1.35	1.40	1.30–1.35
Western New York	.85	1.25	1.25	1.25	1.25	1.25
CENTRAL:						
Alton, Ill. (b)	2.00	.....	2.00	.....	.....	.....
Afton, Mich.	.....	.....	.....	.25	.....	1.50
Cypress, Ill.	.....	1.00	1.00	.90	.90	.85
Davenport, Iowa	1.20	1.50	1.50	1.30	1.30	1.30
Dubuque, Iowa	1.10	1.10	1.10	1.00	1.00	1.00
Stolle and Falling Springs, Ill.	1.05–1.70	.95–1.70	1.15–1.70	1.05–1.70	1.05–1.70	.....
Greencastle, Ind.	1.25	1.10	1.00	.90	.90	.90
Lannon, Wis.	.80	1.00	1.00	.90	.90	.90
McCook, Ill.	.80	1.00	1.00	1.00	1.00	1.00
Montreal, Canada	.75–1.00	1.65–1.85	1.45	1.15	1.05	.95
Sheboygan, Wis.	1.10	1.10	.....	.....	.....	.....
Stone City, Iowa	.75	.....	1.10	1.00	1.00	1.00h
Toledo, Ohio	1.60	1.70	.....	1.60	.....	1.60
Toronto, Canada	2.50	3.00	2.50	2.50	2.50	2.50
Waukesha, Wis.	.....	.90	.90	.90	.90	.....
SOUTHERN:						
Cartersville, Ga.	1.15	1.35	1.35	1.15	1.00	1.00
Chico, Texas	.75	1.30	1.25	1.20	1.15	.....
Cutler, Fla.	.50r	1.75r	1.75r	1.75r	1.75r	1.50r
El Paso, Texas (v)	.75r	1.25	1.25	1.00	1.00	1.00
Graystone, Ala.	Crusher run stone 1.00 per net ton					
Olive Hill, Ky.	.50–1.00	1.00	1.00	.90	.90	.90
Rocky Point, Va.	.50– .75	1.40–1.60	1.30–1.40	1.15–1.40	1.10–1.20	1.00–1.05
WESTERN:						
Atchison, Kan.	.50	1.80	1.80	1.80	1.80	1.70
Blue Springs and Wymore, Neb. (t)	.25	.25	1.45	1.35c	1.25d	1.20
Cape Girardeau, Mo.	1.00	1.25	1.25	1.25	1.00	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
Rock Hill, St. Louis Co., Mo.	1.30–1.40	1.30–1.40	1.10–1.40	1.30–1.40	1.30–1.40	1.30–1.40
Stringtown, Okla.	1.00	1.15	1.20	1.15	1.00	1.00

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Birdsboro, Penn. (q)	1.20	1.60	1.45	1.35	.....	1.30
Branford, Conn.	.80	1.70	1.45	1.20	1.05	.....
Farmington, Conn.	1.00	1.30	1.30	1.00	1.00	.....
Duluth, Minn.	1.00	2.25	1.75	1.65	1.35	1.25
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.25	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.10	1.70	1.60	1.50	1.35	1.35
Knippa, Texas	1.15	1.25	1.50	1.30	1.15	1.10
New Britain, Plainville, Rocky Hill, Wallingford, Meriden, Mt. Carmel, Conn.	.80	1.70	1.45	1.20	1.05	.....
Northern New Jersey	1.35	2.10	1.90	1.50	1.50	.....
Richmond, Calif.	.75	.....	1.00	1.00	1.00	.....
Toronto, Canada	4.70	5.80	4.05	4.05	.....	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	.....

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Cayce, S. C.—Granite	.....	.....	1.60	1.60	1.50	.....
Chicago, Ill.—Granite	2.00	1.70	.....	1.50	1.50	.....
Eastern Pennsylvania—Sandstone	1.35	1.70	1.65	1.40	1.40	1.40
Eastern Pennsylvania—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia, Ga.—Granite	.50	1.50	1.40	1.25	1.15	.....
Lohrville, Wis.—Granite	1.80	1.60	.....	1.50	1.50	.....
Middlebrook, Mo.—Granite	3.00–3.50	.....	2.00–2.25	2.00–2.25	.....	1.25–3.00
San Gabriel and San Fernando Valleys, Calif. (Granite)	1.10	.....	1.10	1.10	.....	1.30
(Basalt)	.....	.....	.....	.85	.....	.....
Toccoa, Ga.—Granite	.50	1.35	1.35	1.25	1.25	1.20

(b) Wagonloads. (c) 1 in., 1.40. (d) 2-in., 1.30. (e) Price net after 10c discount deducted. (h) Rip rap. (n) Ballast, R. R., .90; run of crusher, 1.00. (q) Crusher run, 1.40; ¼-in. granlithic finish, 3.00. (r) Cu. yd. (t) Rip rap, 1.20–1.40 per ton. (v) Roofing stone, 1.50 per ton.

Crushed Slag

City or shipping point	Roofing	¼ in. down	½ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Allentown, Penn.	1.00–1.50	.40– .60	.80–1.00	.50– .80	.50– .80	.60– .80	.80
Bethlehem, Penn.	1.25–1.50	.50– .60	1.00	.60– .80	.70– .80	.70– .90	.90
Buffalo, N. Y., Erie and Du Bois, Penn.	2.25	1.25	1.25	1.35	1.25	1.25	1.25
Reading, Penn.	2.00	1.00	.....	1.00	.....	.....	.....
Swedeland, Penn.	1.50–2.50	.60–1.10	1.00–1.25	.90–1.25	.90–1.25	1.25	1.25
Western Pennsylvania	2.00	1.25	1.25	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05*	1.30*	1.80*	1.45*	1.45*	1.45*	.....
Jackson, Ohio	2.05	.65	1.80	1.45	1.05	1.30	.....
Toledo, Ohio	1.50	1.10	1.35	.135	1.35	1.35	1.35
SOUTHERN:							
Ashland, Ky.	2.05	1.05	1.65	1.45	1.45	1.45	.....
Ensley and Alabama City, Ala.	2.05	.55	1.25	1.15	.90	.90	.80
Longdale, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.05
Woodward, Ala.†	2.05*	.55*	.....	1.15*	.90*	.90*	.....

5c per ton discount on terms. †1½-in. to ¼-in., 1.05; ⅝-in. to 10 mesh, 1.25*; ⅝-in. to 0-in., 90c*; ¼-in. to 10 mesh, .80*.

Agricultural Limestone

(Pulverized)

Alton, Ill.—Analysis, 99% $CaCO_3$; 0.3% $MgCO_3$, 90% thru 100 mesh 4.50

Cape Girardeau, Mo.—Analysis, $CaCO_3$, 94½%; $MgCO_3$, 3½%; 90% thru 50 mesh 1.50

Carterville, Ga. 2.00

Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, per ton 6.00

Gibsonburg, Ohio—Bulk, 2.25; in bags.... 3.70

Hillsville, Penn. 2.10–4.50

Jamesville, N. Y.—Bulk, 3.50; in 80-lb. bags 4.75

Joliet, Ill.—Analysis, 50% $CaCO_3$; 44% $MgCO_3$; 90% thru 200 mesh 3.50

Knoxville, Tenn.—Analysis, 52% $CaCO_3$; 36% $MgCO_3$; 80% thru 100 mesh, bags, 3.75; bulk 2.50

Marion, Va.—Analysis, 90% $CaCO_3$, 2% $MgCO_3$; per ton 2.00

Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh 4.25

Olive Hill, Ky., per ton 50–1.00

West Rutland, Vt. — Analysis, 96.5% $CaCO_3$; 1% $MgCO_3$, in 100-lb. burlap bags, per ton 4.50

Agricultural Limestone

(Crushed)

Bedford, Ind.—Analysis, 98.44% $CaCO_3$; .83% $MgCO_3$; 90% thru 10 mesh 1.50

Cartersville, Ga.—50% thru 50 mesh 1.50

Chico, Tex.—(Agstone, ⅛-in. down), per ton 1.00

Colton, Calif.—Analysis, 95-97% $CaCO_3$; 1.31% $MgCO_3$, all thru 14 mesh down to powder 3.50

Cypress, Ill. — Analysis, 96% $CaCO_3$; 90% thru 100 mesh, 1.25; 50% thru 100 mesh, 1.15; 90% thru 50 mesh, 1.15; 50% thru 50 mesh, 1.15; 90% thru 4 mesh, 1.15, and 50% thru 4 mesh 1.15

Davenport, Iowa — Analysis, 92-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 4 mesh, 50% thru 20 mesh; bulk, per ton 1.20

Dubuque, Ia.—Analysis, 64.04% $CaCO_3$; 29.54% $MgCO_3$; 50% thru 100 mesh.. 1.10

Dundas, Ont.—Per ton 1.00

Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh; bulk, per ton 1.15–1.50

Gibsonburg, Ohio—90% thru 10 mesh.... 1.00–1.50

Hillsville, Penn.—75% thru 100 mesh, 50% thru 100 mesh and 90% thru 50 mesh (sacked) 5.00

Lannon, Wis. — Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% thru 10 mesh; 46% thru 60 mesh 2.00

Screenings (¼-in. to dust) 1.00

Marblehead, Ohio—90% thru 100 mesh.... 3.00

90% thru 50 mesh 2.00

90% thru 4 mesh 1.00

McCook and Gary, Ill.—Analysis, 60% $CaCO_3$, 40% $MgCO_3$; 90% thru 4 mesh ..... .80

Oshorne, Penn.—100% thru 20 mesh, 60% thru 100 mesh, and 45% thru 200 mesh, per ton a5.00

Piqua, Ohio—30%, 50% and 99% thru 100 mesh 1.00–4.00

Rocky Point, Va.—50% thru 200 mesh, bulk, in carloads, 2.00; 100-lb. paper bags, 3.25; 200-lb. burlap bags 3.50

Stolle and Falling Springs, Ill.—Analysis, 89.9% $CaCO_3$, 3.8% $MgCO_3$; 90% thru 4 mesh 1.15–1.70

Stone City, Ia.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh ..... .75

West Stockbridge, Mass.* — Analysis, 95% $CaCO_3$; 90% thru 100 mesh, bulk 3.50

100-lb. paper bags, 4.75; 100-lb., cloth.. 5.25

Waukesha, Wis.—90% thru 100 mesh, 3.50; 50% thru 100 mesh 2.10

*Less 25c cash 15 days. (a) Less 50c commission.

Pulverized Limestone for Coal Operators

Davenport, Iowa—Analysis, 97% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton.. 6.00

Hillsville, Penn.—Sacks, 5.10; bulk 3.50

Joliet, Ill.—Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh (bags extra) 3.50

Piqua, Ohio—99% thru 100 mesh, bulk, 3.25; in 80-lb. or 100-lb. bags 4.25

Rocky Point, Va.—Analysis, 97% $CaCO_3$; 75% $MgCO_3$; 85% thru 200 mesh, bulk 2.25–3.50

Waukesha, Wis.—90% thru 100 mesh, bulk 3.50

Lime Products

(Carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime In bulk	Lump lime In bbl.
EASTERN:								
Berkeley, R. I.			11.40			17.50		20.65
Rambo, Penn.		9.50b	9.50b	9.50b	8.00d	9.50	8.50	
Knickerbocker, Devault and Lime Ridge, Penn.			8.50		6.50	8.00[3]	4.50	
CENTRAL:								
Afton, Mich.						10.50	6.50	
Cold Springs, Ohio		7.75	7.75				7.00	
Gibsonburg, Ohio	10.50				7.00	9.00[9]		
Little Rock, Ark.		14.40		14.40			11.90	17.90
Luckey, Ohio*	10.50	7.75	7.75				7.00	
Marblehead, Gibsonburg, Marion, Sandusky, Tiffin and White Rock, Ohio	10.50	7.75	7.75	11.00	7.00	9.00	7.00	
Milltown, Ind.		9.00	8.25	9.50	7.50		7.00	
Pittsburgh, Penn.	10.50	7.75	7.75		7.00	9.00	7.00	
Scioto, Ohio	10.50	6.50	6.50	7.50			6.00	
Sheboygan, Wis.		10.50	10.50	10.50			9.50	20.00
Wisconsin points		11.50					9.50	
Woodville, Ohio	10.50	7.75	7.75	11.50[24]	7.00	9.00[9]	7.00	15.00c
SOUTHERN:								
Cartersville, Ga.		9.00				13.50		15.00
Graystone, Ala.*	12.50	9.00		12.50			7.50	
Keystone, Ala.	17.00	9.00		7.00- 9.00			5.00a	14.85
Knoxville, Tenn.	16.00	7.00	7.00	7.00	5.50		5.00	23.00
Ocala, Fla.		10.50						
Pine Hill, Ky.		9.00	8.00	9.00				12.50
WESTERN:								
Colton, Calif.					9.50[4]			
Kirtland, N. M.							15.00	20.00
Los Angeles, Calif.	16.00	13.00	13.00				12.00	22.90
San Francisco, Calif.†	16.00	14.00	6.00–12.00	14.00–19.00	14.50[20]		11.00[19]	
San Francisco, Calif.	19.00	14.00–17.00	12.50	14.00–19.00	14.50[20]		11.00[19]	

[1]Also 6.00. [2]To 1.35. [3]In 100-lb. bags. [4]To 11.85 per ton, granular but not ground, ¼-in. screen down to 14 mesh. [9]In 80-lb. paper. [10]Per bbl. [11]In wood; in steel, 11.60. [12]Less credit for return of empties. [19]To 14.50. [20]Also 13.00. [24]Superfine, 92.25% thru 200 mesh. *Price to dealers. †Wood-burnt lime: finishing hydrate 20.00 per ton, pulv. lime 2.00 per iron drum. Oil-burnt pulv. lime, 13.00–14.50 per ton. ‡To 6.00. ¶To 13.50. (a) To 8.50. (b) In 50-lb. paper. (c) In wood; in steel, 16.00. (d) In 80-lb. bags, for chemical uses.

Wholesale Prices of Slate

Prices given are f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 100% thru 200 mesh, 7.00 per ton in paper bags.

Slate Granules

Esmont, Va.—Blue, $7.50 per ton. Granville, N. Y.—Red, green and black, $7.50 per ton.
Pen Argyl, Penn.—Blue-black, 6.50 per ton in bulk, plus 10c per bag.

Roofing Slate

City or shipping point:	Prices per square—Standard thickness. 3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Arvonia, Va.—						
Buckingham oxford grey	13.88	17.22	24.99	29.44	34.44	45.55
Bangor, Penn.—						
Gen. Bangor No. 1 clear	10.00–14.50	20.00	25.00	29.00	40.00	50.00
Gen. Bangor No. 1 ribbon	9.00–10.25	16.00	20.00	25.00	35.00	46.00
Gen. Bangor mediums	9.00–10.50					
Gen. Bangor No. 2 ribbon	6.75– 7.25					
Chapman Quarries, Penn.	7.75–11.25	13.00–15.00	19.00–22.00	23.00–28.00	27.00–30.00	32.00–35.00
Granville, N. Y.—						
Sea green, weathering	14.00	24.00	30.00	36.00	48.00	60.00
Semi-weathering, green & gray	15.40	24.00	30.00	36.00	48.00	60.00
Mottled purple & unfading gr'n	21.00	24.00	30.00	36.00	48.00	60.00
Red	27.50	33.50	40.00	47.50	62.50	77.50
Pen Argyl, Penn.						
Blue grey	8.50	10.50	15.00	18.00		
Graduated slate		16.00	23.00	27.00	37.00	46.00
No. 1 clear (smooth text)	7.25–10.50; Albion-Bangor medium, 8.00			9.00; No. 1 ribbon, 8.00–8.50		
Slatedale and Slatington, Penn.—						
Genuine Franklin	11.25	22.00	26.00	30.00	40.00	50.00
Blue Mountain No. 1	10.50	22.00	26.00	30.00	40.00	50.00
Blue Mt., No. 1 & No. 2 clear	8.00– 9.50	18.00	22.00	26.00	36.00	46.00

(a) Prices are for standard preferred sizes (standard 3/16-in. slates), smaller sizes sell for lower prices.
(b) Prices other than 3/16-in. thickness include nail holes.
(c) Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point

Chatsworth, Ga.:
- Crude talc, per ton 5.00
- Ground talc (20-50 mesh), bags 6.50
- Ground talc (150-200 mesh), bags 9.00
- Pencils and steel crayons, gross 1.50– 2.00

Chester, Vt.—Finely ground talc (carloads), Grade A—99-99¾% thru 200 mesh, 8.00–8.50; Grade B, 97-98% thru 200 mesh 7.50– 8.00
1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of bags. Terms 1%, 10 days.

Clifton, Va.:
- Ground talc (150-200 mesh), in bags 10.00

Conowingo, Md.:
- Crude talc, bulk 4.00
- Ground talc (150-200 mesh), in bags 14.00
- Cubes, blanks, per lb. .10

Emeryville, N. Y.:
- Ground talc (200 mesh), bags 13.75
- Ground talc (325 mesh), bags 14.75

Hailesboro, N. Y.:
- Ground talc (300-350 mesh), in 200-lb. bags 15.50–20.00

Henry, Va.:
- Crude (mine run), bulk 3.50– 4.50
- Ground talc (150-200 mesh), bags 6.25– 9.75

Joliet, Ill.:
- Ground talc (200 mesh) in bags:
  - California talc 30.00
  - Southern talc 20.00
  - Illinois talc 10.00

Los Angeles, Calif.:
- Ground talc (150-200 mesh), in bags 15.00–25.00

Natural Bridge, N. Y.:
- Ground talc (325 mesh), bags 10.00–15.00

Rock Phosphate

Prices given are per ton (2240 lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 65-70% 3.50– 4.00
Mt. Pleasant, Tenn.—B.P.L. 76-78% 6.75

Ground Rock

(2000 lb.)

Gordonsburg, Tenn.—B.P.L. 65-70% 3.50– 4.00
Mt. Pleasant, Tenn.—Lime Phosphate: B.P.L. 73.25% 11.80
Mt. Pleasant, Tenn.—B.P.L. 72% 5.00– 5.50

Florida Phosphate

(Raw Land Pebble)

Mulberry, Fla.—Gross ton, f.o.b. mines
- 68/66% B.P.L. 3.15
- 70% minimum B.P.L. 3.75
- 72% minimum B.P.L. 4.25
- 75/74% B.P.L. 5.25
- 77/76% B.P.L. 6.25

Mica

Prices given are net, f.o.b. plant or nearest shipping point.

Pringle, S. D.—Mine run, per ton 100.00–125.00
- Punch mica, per lb. .06
- Scrap, per ton, carloads 20.00

Rumney Depot, Bristol and Cardigan, N. H.—Per ton:
- Punch mica, per ton 150.00–240.00
- Mine scrap 22.50
- Mine run 325.00
- Clean shop, scrap 25.00
- Roofing mica 37.50
- Trimmed mica, per ton, 20 mesh, 37.50; 40 mesh, 40.00; 60 mesh, 40.00; 100 mesh, 45.00; 200 mesh 60.00

Spruce Pine, N. C.—Mine scrap, per ton 20.00

Trenton, N. J.—Mine scrap, per ton, f.o.b. mines 18.00

Gypsum Products— CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ¼x32x 36". Per M Sq. Ft.	⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48' Lengths 6'-10'. Per M Sq. Ft
Centerville, Iowa			6.00	7.00		7.50	8.50	10.50a					
East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton, floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 6 in. long, 17c per ft., 23.00 per ton.													
Fort Dodge, Iowa	2.50	6.00	6.00	7.00	9.00	9.00	11.50	8.00	16.00	20.00	15.00		25.00
Grand Rapids, Mich. (h)			7.00	9.00	9.00d	9.50d	19.50	8.00d	26.00	20.00d			25.00
Los Angeles, Calif. (b)	3.90	7.50	7.00–7.50	8.00–8.20	9.00		9.00						
Medicine Lodge, Kan.	1.40						11.50d		16.00d				
Oakfield, N. Y.	3.00			6.00	9.00d	9.00d		6.00					
Port Clinton, Ohio	3.00	4.00	6.00	9.00	9.00	9.00	20.00	8.00	25.50	20.00i		15.00	25.00
Portland, Ore.	7.50		11.50d	16.00d									
Providence, R. I. (x)				12.00–13.00e									
San Francisco, Calif.	6.00		10.20d	13.90d									
Seattle, Wash.	6.60		10.00d	14.00d									
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00					20.00	25.00g	33.00

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) White molding. (b) Plasterboard, ⅜x32x36-in., 16c per yd. (d) Includes paper bags. (e) Includes jute sacks. (f) "Gyproc," ⅜x48-in. by 5 and 10 ft. long. (g) ⅜x48-in. by 3 to 4 ft. long. (h) Gypsum lath, per M sq. ft., 15.00. (i) To 26.00. (x) "Fabricate" gypsum blocks, 2- and 3-in., f.o.b. motor trucks at plant, 7¼c-8¼c. Block setting plaster, per ton, in jute sacks, 12.00. (y) Jute sacks, 18.00; paper sacks, 16.00.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	¶12.50	‖14.50 ¶12.50–‖14.50
Cranberry Creek, N. Y.—Bio-Spar, per ton in bags in carload lots, 9.00; less than carload lots, 12.00 per ton in bags; bulk, per ton		7.50
Crown Point, N. Y.—Mica Spar		¶9.00–‖12.00
Davenport, Iowa — White limestone, in bags, per ton	‖6.00	‖6.00
Harrisonburg, Va.	12.50-14.50	
Middlebrook, Mo.—Red		20.00–25.00
Middlebury, Vt. — Middlebury white		¶9.00–‖10.00
Middlebury and Brandon, Vt.—Caststone, per ton, including bags		c5.50
Phillipsburg, N. J.—In bags		10.00
Randville, Mich.—Crystalite white marble, bulk	4.00	4.00– 7.00
Tuckahoe, N.Y.—Tuckahoe white	7.00	
Warren, N. H (d)		¶8.00– 8.50
Whitestone, Ga.		10.00

¶C.L. ‖L.C.L. (a) Including bags. (b) In burlap bags, 2.00 per ton extra. *Per 100 lb. (c) Per ton f.o.b. quarry in carloads; 7.00 per ton L.C.L. (d) L.C.L., 9.50–15.00 per ton in 100-lb. bags.

Soda Feldspar

De Kalb Jct., N. Y.—Color, white; pulverized (bags extra, burlap 2.00 per ton, paper 1.20 per ton); 99% thru 140 mesh, 16.00; 99% thru 200 mesh, per ton	18.00

Potash Feldspar

Auburn and Topsham, Me.—Color white, 98% thru 140 mesh (bulk)	19.00
Keystone, S. D.—Color, white; analysis, K_2O, 12%; NaO, 2.50%; SiO_2, 65%; Fe_2O_3, 0.05%; Al_2O_3, 19%, pulverized, 99% thru 200 mesh; in bags, 16.00; bulk	15.00
Crude, in gats, 9.00; bulk	7.50
Coatesville, Penn.—Color, white, analysis, K_2O, 12.30%; Na_2O, 2.86%; SiO_2, 66.05%; Fe_2O_3, .08%; Al_2O_3, 18.89%; crude, per ton	8.00
Erwin, Tenn.—White; analysis, K_2O, 10.50%; Na_2O, 2.76%; SiO_2, 67.92%; Fe_2O_3, .07%; Al_2O_3, 18%, pulverized, 99% thru 200 mesh, in bags, 16.20; bulk	15.00
Crude, in bags, 8:20; bulk	7.00
Rumney and Cardigan, N. H. — Color, white; analysis, K_2O, 9-12%; Na_2O, trace; SiO_2, 64-67%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Rumney Depot, N. H.—Color, white; analysis, K_2O, 8-13%; Na_2O, 1-1½%; SiO_2, 61-68%; Al_2O_3, 17-18%, crude, bulk	7.00– 7.50
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 3%; SiO_2, 68%; Fe_2O_3, 0.10%; Al_2O_3, 18%; 99½% thru 200 mesh; pulverized, bulk (bags, 15c extra)	18.00

Cement Drain Tile

Graettinger, Iowa — Drain tile, per foot; 5-in., .04½; 6-in., .05½; 8-in., .09; 10-in., .12½; 12-in., .17½; 15-in.. .35: 18-in.. .50; 20-in.. .60; 24-in., 1.00; 30-in., 1.35; 36-in.	2.00
Grand Rapids, Mich.—Drain tile, per 1000 ft.	
4-in.	36.00
6-in.	66.00
8-in.	100.00
10-in.	150.00
12-in.	210.00
Longview, Wash.—Drain tile, per 100 ft.	
3-in.	5.00
4-in.	6.00
6-in.	10.00
8-in.	15.00
Tacoma, Wash.—Drain tile, per 100 ft.	
3-in.	4.00
4-in.	5.00
6-in.	7.50
8-in.	10.00

Chicken Grits

Centerville, Iowa	9.25
Cypress, Ill.—(Agstone)	1.15
Belfast, Me.—(Agstone), per ton, in carloads	10.00
Chico, Tex.—Hen size and Baby Chick, packed in 100-lb. sacks, per 100 lb. sack	1.00
Coatesville, Penn.—(Feldspar), per ton, in bags of 100 lb. each	8.00
Cranberry Creek, N. Y.—Per ton, in carload lots, in bags, 9.00; bulk, 7.50. Less than carload lots, in bags	12.00
Davenport, Iowa—High calcium carbonate limestone, in bags, L.C.L., per ton	6.00
El Paso, Tex.—(Limestone), per 100-lb. sack	.75
Los Angeles, Calif.—(Gypsum), per ton, including sacks	7.50– 9.50
Middlebury, Vt.—Per ton (a)	10.00
Piqua, Ohio—(Pearl grit), No. 1 and No. 2	1.00– 4.00
Port Clinton, Ohio—(Gypsum), per ton	6.00
Randville, Mich.—(Marble), bulk	6.00
Seattle, Wash.—(Gypsum), bulk, ton	10.00
Warren, N. H.	8.50– 9.50
Waukesha, Wis.—(Limestone), per ton	7.00
West Stockbridge, Mass.	‖7.50–‖9.00
Wisconsin points—(Limestone), per ton	15.00

(a) F.o.b. Middlebury, Vt. ¶C.L. ‖L.C.L.

Sand-Lime Brick

Prices given per 1000 brick f.o.b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis. (at plant)	9.50
Dayton, Ohio	12.50
Detroit, Mich.	13.00
Farmington, Conn.	16.00
Flint, Mich.	*14.00–15.50b
Grand Rapids, Mich.*	14.50
Iona, N. J.	10.50–12.00
Jackson, Mich.	13.00
Madison, Wis.	12.50a
Milwaukee, Wis.	13.00*
Minneapolis, Minn.	10.00*
Mishawaka, Ind.	11.00
New Brighton, Minn.	8.00
Pontiac, Mich. (e)	15.50
Portage, Wis.	15.00
Rochester, N. Y.	19.75
Saginaw, Mich.	13.50
San Antonio, Texas	12.00
Sebewaing, Mich. (at yard)	12.50
South River, N. J.	11.00
South St. Paul, Minn.	9.00
Syracuse, N. Y.	18.00–20.00
Toronto, Canada	12.00–b13.00*
Wilkinson, Fla.—White, 10.00; buff	14.00
Winnipeg, Canada	15.00

*Delivered on job. (a) Less 50c disc. per M 10th of month. (b) 5% disc., 10 days. (c) Delivered in city. (e) Truck delivery.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

City or shipping point	Size 8x8x16
Appleton, Minn.	18.00–20.00
Franklin Park, Ill.:	
8x8x16. Per 1000	180.00
Chicago, Ill.:	
8x 8x16. Each	.21†
8x 8x16. Each	.18b
8x10x16. Each	.25†
8x10x16. Each	.22b
8x12x16. Each	.28†
8x12x16. Each	.25b
Columbus, Ohio: 8x8x16	14.00b–16.00a
Forest Park, Ill.	21.00*
Graettinger, Iowa	.18– .20
Indianapolis, Ind.	.10– .12a
Lexington, Ky.:	
8x8x16	a18.00*
8x8x16	b15.00*
Los Angeles, Calif.:	
4x8x12	4.50*
4x6x12	3.90*
4x4x12	2.90*

*Price per 100 at plant.
†Rock or panel face.
(a) Face. (b) Plain. (c) Common.

Cement Roofing Tile

Prices are net per square, carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Clyde, Ill.—French tile, 8½x15 in., per sq., 9.50–12.00; Spanish, 8½x15 in.. per sq., 10.00–12.00; English Shingle, 7¼x12½ in., per sq., 13.50–15.50; Closed End Shingle. 8x12½ in., per sq.	11.00–13.00
Detroit, Mich.—5x8x12, per M	67.50
Indianapolis, Ind.—9x15-in.	Per sq
Gray	10.00
Red	11.00
Green	13.00
Lexington, Ky.—8x15, per sq.:	
Red	15.00
Green	18.00
Longview, Wash.:	
4x6x12-in., per 1000	55.00
4x8x12-in., per 1000	65.00

Cement Building Tile

Chicago District (Haydite):	
8x 4x16, per 1000	140.00
8x 8x16, per 1000	200.00
8x12x16, per 1000	300.00
Columbus, Ohio:	
5x8x12. per 100	6.00
Lexington, Ky.:	
5x8x12, per 1000	55.00
4x5x12, per 1000	35.00
Longview, Wash. (Stone Tile):	
4x6x12, per 1000	57.50
4x8x12, per 1000	65.00

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Camden & Trenton, N. J.	17.00	
Chicago District "Haydite"	14.00	
Columbus, Ohio	16.00	17.00
Ensley, Ala. ("Slagtex")	10.00–13.00a	
Forest Park, Ill.		37.00
Longview, Wash.	16.50	23.00– 40.00
Milwaukee, Wis.	14.00	20.00
Omaha, Neb.	18.00	30.00– 40.00
Philadelphia, Penn.	15.50	
Portland, Ore.	12.00	22.50– 55.00
Prairie du Chien, Wis.	14.00	22.50– 25.00
Rapid City, S. D.	18.00	25.00– 40.00

(a) Delivered on job; 10.00 f.o.b. plant.

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00

Stone-Tile Hollow Brick

Prices are net per thousand f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Asheville, N. C.	35.00	50.00	60.00
Atlanta, Ga.	29.00	42.50	53.00
Brownsville, Tex.		53.00	62.50
Brunswick, Me.†	40.00	60.00	80.00
Charlotte, N. C.	35.00	45.00	60.00
De Land, Fla.	30.00	50.00	60.00
Farmingdale, N. Y.	37.50	50.00	60.00
Houston, Tex.	35.00	45.00	60.00
Jackson, Miss.	45.00	55.00	65.00
Klamath Falls, Ore.	65.00	75.00	85.00
Longview, Wash.		55.00	64.00
Los Angeles, Calif.	29.00	39.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	50.00	55.00	65.00
Mineola, N. Y.	45.00	50.00	60.00
Nashville, Tenn.	30.00	49.00	57.00
New Orleans, La.	35.00	45.00	60.00
Norfolk, Va.	35.00	50.00	65.00
Passaic, N. J.	40.00	52.50	70.00
Patchogue, N. Y.		60.00	70.00
Pawtucket, R. I.	35.00	55.00	75.00
Safford, Ariz.	32.50	48.75	65.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size 3½x8x12 in. *Delivered on job. †10% discount.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4 in.	6 in.	8-in.	10-in.	12-in.	15 in.	18-in.	20-in.	22-in.	24-in.	27-in.	30-in.	36-in.	42-in.	48-in.	54 in.	60-in.
Grand Rapids, Mich.(b)																	
Sewer	.....	.12	.18	.27½	.35	.47	.92½	1.11	.....	1.66½	2.47	2.73⅔	.....	.....	.....	.....	.....
Culvert	.....	.....	.....	.57	.67	.93	1.20	.....	.....	1.80	2.10	2.25	3.35	4.00	5.60	6.90	7.85
Indianapolis, Ind. (a)	.....	.....	.....	.75	.85	.90	1.15	.....	.....	1.60	.....	2.30	.....	.....	.....	.....	.....
Newark, N. J. (d)	.....	.....	.....	.....	.90	1.15	1.50	.....	.....	1.85	2.35	2.76	3.77	4.93	6.21	7.66	9.28
Unreinforced	.....	.....	.16	.25	.37	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Norfolk, Neb. (b)	.....	.....	.....	.....	.90	1.00	1.13	1.42	.....	.....	2.11	.....	2.75	3.58	.....	6.14	.....
Tiskilwa, Ill. (rein.)	.....	.....	.....	.....	.75	.85	.95	1.20	1.60	.....	2.00	.....	2.75	3.40	.....	6.50	.....
Tacoma, Wash.	.....	.14	.16	.22	.32	.45	.64	.90	.....	.....	.....	.....	.....	.....	.....	.....	.....
Wahoo, Neb. (c)	.....	.....	.....	.....	.....	.85½	.....	1.14	.....	1.81	.....	.....	2.47	3.42	4.13	5.63	6.49

(a) 24-in. lengths. (b) Sewer, 21-in., 1.48; culvert, 21-in., 1.45. †21-in. diam. (c) Reinforced, 15.40 per ton, f.o.b. plant. (d) Reinforced; 21-in., 1.69; unreinforced, 21-in., 1.26; 5% cash discount.

New Machinery and Equipment

Automatic Weighing Device

A NEW TYPE of weighing device has been announced by Messrs. Edgar Allen and Co., Ltd., of Sheffield, Eng., and is used for recording the weight of any materials such as cement clinker, gypsum, limestone and other materials of a granular nature. It is not suitable for large lumps, but can be adapted for use with dry powders, when provided with a dust casing. The machine is said to be suitable for checking the output of rotary kilns in cement works.

It is of strong construction, simple in action, and requires no power to drive it; its automatic action is entirely due to the force of gravity.

The machine is fed with a continuous flow of material from a conveyor that gives a steady flow, and from which a chute can be arranged so as to deposit the material in the uppermost compartment of the drum "A."

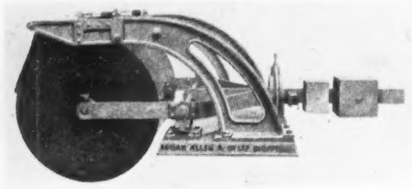
This drum is free to revolve on its center spindle in one direction only, and is divided into four compartments. The large balance weight on the back arm on the scale beam should be set so that it balances the weight of the drum on the other end. The small balance weight is then set to give the required weight of material for each tip.

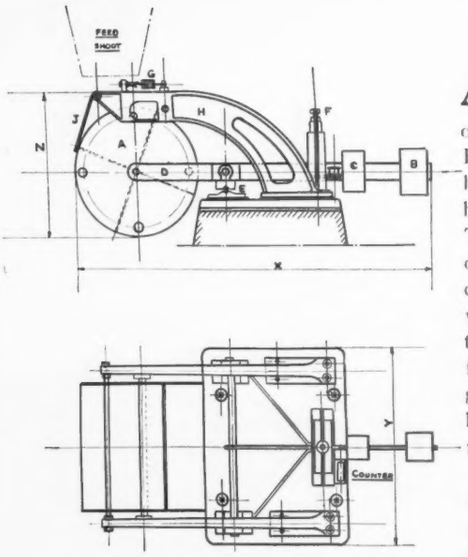
The action of the machine is then as follows:

When the weight of the material overcomes the balance weight the scale beam dips and the drum revolves one-quarter of a turn, the compartment empties, and the balance weight brings it back into the filling position at once, so that there is no spill. This operation continues as long as the apparatus is fed with material, and a counter which is fitted to the weigher registers the number of tips, so that it is only necessary to multiply the reading of the counter by the standard weight of one tip, which has been ascertained previously, to obtain the quantity passing in a given period.

The whole apparatus is mounted on a substantial baseplate, and with the baseplate provides a most simple and accurate means of determining the weight of material passing through it.

The weighers come in various sizes, the most popular being the 36-in. width.

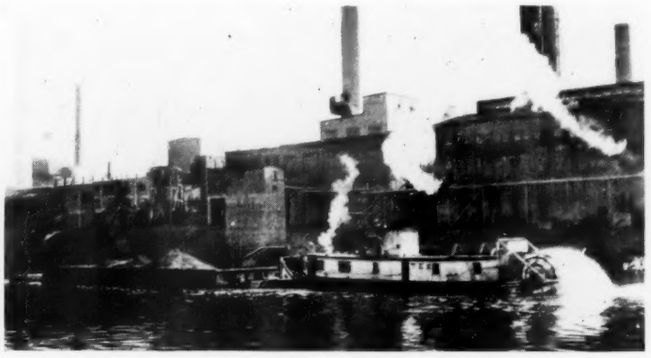




Above, side view, and, below, plan of new type automatic weighing device being produced by English firm

Material Handling Equipment

AN illustrated handbook on material handling equipment has just been issued by the Robins Conveying Belt Co., New York City. The book contains 300 pages and is divided into fourteen sections, covering belt conveyors, bucket elevators, coal storage and reclaiming, crushers for coal and coke, dragline scrapers, feeders, grizzlies and screens, hoppers and gates, skip hoists, towers and bridges, transmission machinery, weigh larries, winches, wheels and haulage equipment. Tables of dimensions, capacities and other information is given in the book, which describes the company's complete line in a most comprehensive way. Helpful data on estimating requirements and selecting the proper type of equipment is also given.



Tug boat Tex of the Ohio River Dredging Co., has a 4-cylinder gas engine with rope-drive and belt-drive as features

Protective Lacquers

ALKYD RESINS, marketed under the trade name of "Glyptal," are now being offered in lacquers produced by the General Electric Co. These lacquers are claimed to be resistant to all mineral oils and when baked withstand gasoline, kerosene, etc. They are resistant to temperatures in excess of 600 deg. F. and form a suitable protective coating for surfaces difficult to coat as galvanized iron, aluminum, etc., according to the manufacturers. Some of the applications for Glyptal lacquers are as a seal against oil, gas and water; protective coating for insulation of generators, storage battery equipment and other electrical equipment.

These lacquers are applied by spraying, brushing or dipping; they are air-dry in 30 min., may be handled in 2 hr. and set hard in 10 hr. Heat accelerates the drying time and baking improves the coating. They are available in aluminum, blue, brown, green, gray, black and red.

Gasoline Engine Powers New Type River Tug Boat

A NEW and unusual field for a four-cylinder, 6⅜x7-in. Hercules gasoline engine is for operation of the tug boat *Tex* of the Ohio River Dredging Co., Huntington, W. Va. Its power hook-up is also unique in marine construction, in being accomplished by means of a special arrangement of Texrope drive and belts, to avoid direct shocks to the engine and transmission machinery.

The *Tex* is 61½ ft. long and 12 ft. wide, with a draft of 2 ft. 6 in., and is controlled entirely from the pilot house by one man. It is capable of a speed of 10 miles per hour and can make 4¼ miles per hour pushing two barges of sand having a total gross displacement of 850 tons.

The engine is capable of developing 90 hp. at 800 r.p.m, and through the transmission equipment mentioned gives a wheel speed of 29 r.p.m.

Portable Crushing, Screening and Loading Plant

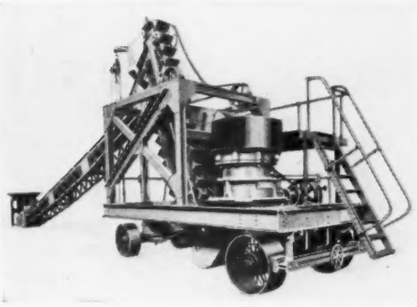
THE SMITH ENGINEERING WORKS, Milwaukee, Wis., announces a new unit claimed to be the first portable crushing, screening and loading plant equipped with a gyratory crusher.

The new unit, it is said, will deliver two accurately sized products. The plant may be equipped with a No. 32 Telsmith reduction crusher, to deliver sand and minus ¾-in. rock, or with a 6-A or 8-A Telsmith primary breaker to deliver sand and minus 1½-in. rock, and since the crusher is in closed circuit with the screen, there is no oversize.

For quarry operations, state the manufacturers, adding either a 10-A Telsmith primary breaker or jaw crusher, at the foot of the feed conveyor, converts it into a two-crusher plant with a larger capacity of ¾-in. or 1-in. product. If only one final product is desired, the plant can be furnished with a single-deck vibrating screen and only one finished product conveyor, the steel conveyor for coarse finished product being omitted. The second deck for the vibrator and the second finished product conveyor, can be added at any time if it is desired to change to a two-product plant.

The standard plant requires a 40- to 45-hp. electric motor, and has six units as follows: (1) steel receiving hopper with reciprocating plate feeder; (2) steel frame feed conveyor with 2-wheel trucks; (3) crushing and screening plant, mounted on heavy trucks with double-deck vibrating screen, gyratory crusher, elevator to return crushed product to screen, jib crane and steel operator's platform; (4) steel conveyor for fine finished product; (5) steel conveyor for coarse finished product; (6) two-compartment, all-steel storage bin for loading trucks.

The plant is all steel and equipped with anti-friction bearings throughout. All the conveyors are equipped with three-pulley troughing idlers with anti-friction bearings. The total weight of the plant is 53,800 lb.



New portable screening and loading plant is equipped with gyratory crusher

Crawler Type Underground Shovel

THE NORDBERG MANUFACTURING CO., Milwaukee, Wis., has developed a new crawler mounting for the Nordberg-Butler underground shovel which materially broadens its application.

With both rail and crawler models, the shovel proper is identical, the only difference being in the form of mounting. The principal advantage of the crawler type machine over the rail mounted model is the saving of time by eliminating the need of placing short rail sections as the drift advances. Instead of laying down substantial track, temporary rails can be placed for the handling of cars, with little time lost in getting the shovel into action. A comparison of the two types of shovels on the same job, it is claimed, shows a saving in time of about 50% in favor of the crawler. It is said that a considerable saving in time is also possible in the cleaning up of fly dirt, for such material as may be thrown back into the drift at the time of blasting can easily be picked up, due to the ease in which the machine can be moved along the drift.

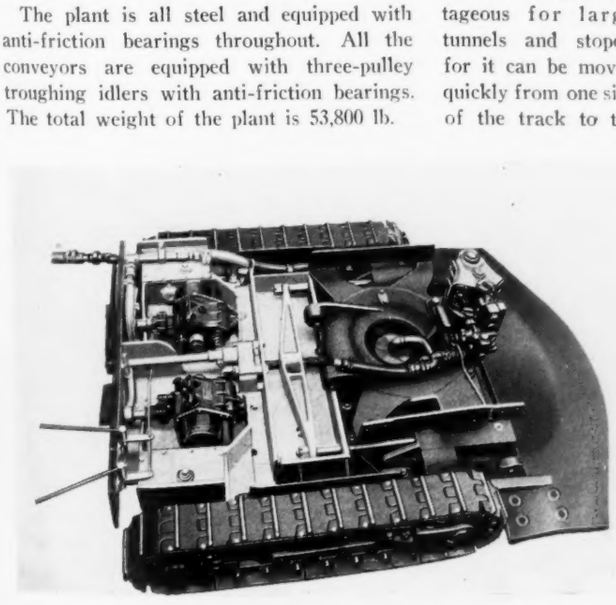
The crawler type shovel, it is claimed, will also be found advantageous for large tunnels and stopes, for it can be moved quickly from one side of the track to the other, and since it will load from either side, it gives an extremely wide clean-up patch.

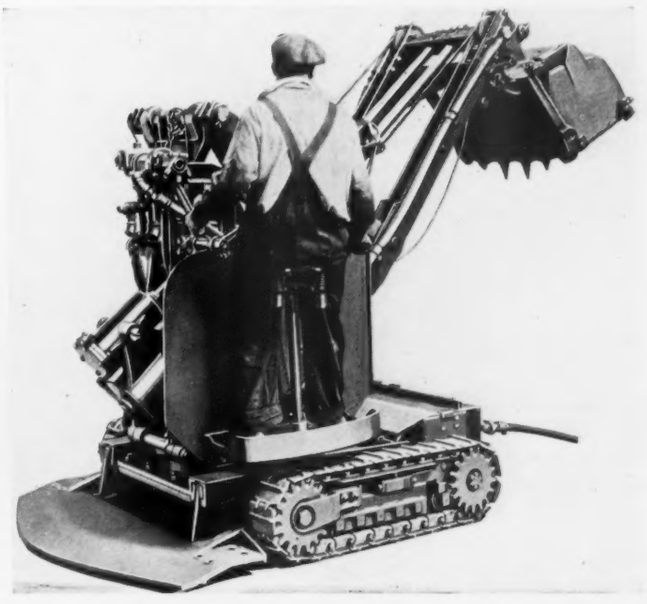
It operates on compressed air, all the actions for the dipper being secured from a single, direct-acting, thrust cylinder. The full-revolving motion, together with the drive of the two crawler treads, are obtained from 2½-hp. air motors of four-cylinder design. The shovel operates on air at 80 to 85 lb. pressure, and requires from 150 to 165 cu. ft. per min.

The crawler is of all-steel construction, the treads being of special alloy steel, and the pins holding the tread sections in place are of hardened steel. Positive take-up of the treads is accomplished by means of shims. At the front of the machine is a wide shoe, which takes the downward strain exerted by the dipper when crowding and raising, and which can readily be lifted and lowered by means of a ratchet lever located at the back of shovel, the operating mechanism consisting of a shaft, screw, equalizing crosshead and two tension rods. According to the description, in most cases when moving either forward or backward, it is not necessary to change the position of the shoe, as the crawler has ample power to drive the machine over any ordinary material on the bottom of the drift, and this shoe, serving as a support at the front, permits the use of a shorter tread and allows it to be set farther back. It is maintained that this construction saves counterweight that would otherwise be necessary, makes maneuvering easier and quicker and requires less space.

The driving mechanism of the crawler is completely enclosed by tight-fitting covers, and all moving parts requiring lubrication are supplied by a pressure grease system.

By manipulating the two levers both treads can be driven in the same, or in opposite directions. It can be turned in an 8-ft. diameter circle and has a crawling speed of 48 ft. per min.





Showing driving mechanism and action view of underground shovel having crawler mounting

Pertinent Paragraphs

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Interesting items from everywhere condensed and "abstracted" for the benefit of busy readers

By Hugh Sharp

WHAT was considered almost an epoch-making demonstration took place several months ago at one of the prominent machinery firms in Great Britain. Contractors and newspaper men were invited to witness the operation of the first transit concrete mixer ever to be shown in Europe. The affair was sponsored by the Transit Mixers, Inc., through its British concessionaires, the British Steel Piling Co., Ltd.

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A BULLETIN on the Nordberg-Butler shovel coming under our eye reminds us of an amusing incident that occurred at a meeting of the Milwaukee, Wis., Sales Managers Club. One of Nordberg's engineers was demonstrating the use of motion picture projectors in connection with sales work and the subject of the film was the operation of this particular shovel. The Jack-in-the-box antics of the machine made a most interesting movie show. After the exhibition, one of the sales managers, who probably regrets the remark to this day, asked:

"Supposing something happens and the shovel doesn't operate?"

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DINING CAR MENUS now come to the traveler in highly attractive type and paper dress. On most roads the fellow who gets up these folders tries to include in the news section of the food schedule some interesting material concerning the country through which the train is passing. Diners on the Missouri Pacific Lines recently, while waiting for George to bring on the victuals, read an entertaining story on the "Mineral and Chemical Resources of the Western South Central States," written by J. G. Carlisle, director of the industrial development department of the Missouri Pacific. The road's mineral technologist is W. M. Weigel.

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QUARRYING and mining corporations contributed 1% of the $58,801,872 raised in 1929 by 129 community chests, according to a survey just completed by the staff of the National Bureau of Economic Research. These 129 communities represented more than 40% of such enterprises in the country and they raised more than 80% of monies collected for such purpose.

SUNDAY newspaper readers were treated to a highly interesting and well illustrated article recently on the subject of "How the Little Coral Polyp Has Changed the Face of the Earth and Influenced Mankind," printed in the *American Weekly*, which is the colored supplement of so many of our metropolitan dailies. The writer, whose identity is not disclosed, picks up the little coral polyp at infancy and follows its life, growth, subsequent demise and final contribution to our great limestone areas in a most instructive manner. "The mighty work of these creatures, some of whom are no bigger than the head of a pin, puzzled the great Darwin, father of the theory of evolution," he says.

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HUNDREDS of applications for work at the Boulder Dam project on the Colorado river pour into the office of the United States Bureau of Reclamation, in charge of the job, according to Acting Commissioner P. W. Dent. The building of this huge dam involves any number of intricate engineering problems, not the least of which is the location and construction of a town for permanent headquarters. Three sites are being considered. Definite work on the town is expected to start some time in September.

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WIDESPREAD discussion followed the announcement from B. F. Affleck, president of the Universal Atlas Cement Co., that all his plants had gone on a three-shift eight-hour day. Editors and business economic experts throughout the country found in Mr. Affleck's statement much food for thought spread over many columns of type, although he was merely applying to the former Atlas plants a policy adopted by the United States Steel Corp. and all its subsidiaries, some years ago.

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AN INTERESTING description of a modern German limestone quarrying plant, largely equipped with American ideas and machinery, by Paul Ludowigs in the foreign abstract department of this issue brings back pleasant memories of the visit to the United States made by Mr. Ludowigs and other foreign producers during the latter part of 1927. All came to see; some to criticize, and apparently at least Mr. Ludowigs, to buy.

AIRPORT facilities for a greater number of communities will receive a substantial boost by the National Air Races to be held over the model Curtiss-Wright-Reynolds airport from August 23 to September 1. The port is northwest of Chicago. Visitors need have no hesitancy attending this affair because the Cook County Highway Commission is arranging for an elaborate system of traffic control designated to care for the 30,000 cars expected daily. The Milwaukee railroad goes direct to the field. Bus and electric line hook-ups also will be provided. Rock products are finding an enlarged market in airport projects.

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IN discussing the general effect of the new tariff law on the South, *Manufacturers Record* says "that the duty of 6c. per 100 lb. of cement may be regarded as the most important item in this schedule. Duty-free, unrestricted competition by foreign cement, produced by near-pauper labor, now comes to an end, and a Southern industry which manufactured 22,000,000 bbl. in 1929 will be protected against imports which in that year totaled 1,727,900 bbl., valued at only $1,983,240, by cheap foreign conditions."

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PRESENT unsettled conditions have revealed many sick businesses, and there has been a demand for so-called trade doctors. Several such concerns, specializing in management and business engineering, have come to the front recently as specialists in the art of straightening out bad industrial situations. It is reported that these business diagnosticians are busier now than have ever been before in their experience. By reason of their ability to examine the backbones of industries they have been dubbed business chiropractors.

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WHILE TO THE rock products man the average quarry or gravel pit may be a thing of beauty and a joy forever, not so with the civic leaders of Columbus, Ohio, in the throes of a beautifying campaign. One newspaper writer, according to the clipping from the *State Journal* just received, considers something lacking in the picture if the "gravel pits are permitted to remain ugly gashes in the earth." That the rock products operators are willing to co-operate is evident by the generous action of the Marble Cliff Quarries Co. in giving the city some 300 acres of pits. The American Aggregates Co. has donated its vast holdings around the water works.

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WHAT is claimed to be the biggest chain feeder ever made has been installed in an English quarry. It is a 3-in. chain apron, weighing 14 tons and takes the direct impact of 30 tons of stone dumped from a train of 10-ton cars. Each link is 18 in. long and weighs 83 lb. It feeds a 72 x 48-in. jaw crusher and handles blocks of limestone weighing up to 5 tons.

News of All the Industry

Incorporations

Virginia Glass Sand Corp., Winchester, Va., $150,000. Walter R. Talbot.

Concho Washed Sand Co., Inc., Oklahoma City, Okla. Capital increased from $25,000 to $50,000.

Wayne Sand and Gravel Co., Paterson, N. J. Edward J. O'Bryne, Paterson.

Northern Limeshell Products, New Westminster, B. C., 10,000 shares of no par value.

Pilot Butte Sand and Gravel Co., Ltd., Pilot Butte, Sask.

Inter-City Sand and Gravel Co., Eugene, Ore., $8,000. (Plant near Springfield.) Sig Moe, Kenneth R. Chase and Ernest V. Nelson.

Fundy Sand and Gravel Co., St. John, N. B., Canada, $25,000. (Pit located at Negro Point, Saint John county.)

Studley's Concrete Works, Inc., Yarmouth, Mass., 500 shares common no-par stock. President, Gilbert Studley; vice-president, Walter Romer; treasurer, Gilbert Studley, Main St., Bass River, Yarmouth.

Riverside Sand, Gravel and Crushed Stone Co., Amarillo, Tex., $50,000. To mine and market sand and gravel. J. L. Williams, William L. Slayden, G. G. Hayes.

Houston Building Material Co., $45,000. To purchase and sell sand, gravel and cement. W. H. Gemmer, George L. H. Koehler, W. E. Sampson, A. S. Koehler, Myer C. Wagner.

F. A. Rider, Inc., Vestal, N. Y., $100,000, comprising 1000 shares common of $100 par value. To deal in sand and gravel. Fred A. Rider and Merritt C. Robinson of Endicott, N. Y., and Sherman A. Keegan, R.D. 1, Vestal, N. Y.

Worcester Transit Concrete, Inc., Worcester, Mass., 1000 shares common, no par value. (Plant at Auburn, Mass.) President, Richard C. Cleveland; treasurer, Roy N. Grout, 182 Commercial St., Worcester, and George A. Gaskill.

Midwest Flourspar Co., 515 First National Bank Bldg., Springfield, Ill., $100,000. To operate mines, plants, mills and otherwise deal in fluorspar. G. D. Lockie, H. H. Tuttle, B. F. Anderson, Abraham Baker. Correspondent, B. M. Davidson, 1031 Williams Blvd., Springfield.

Quarries

Kokomo Stone Co., Kokomo, Ind., has appointed N. E. Kelb, Indianapolis, Ind., as agent.

Ralph Gable Construction Co., Rapid City, S. D., have received and will put into operation at Pactola a large portable crushing and screening plant, to provide material for road surfacing.

F. L. Belzer, Osage, Iowa, plans to open a quarry and crushing plant at Floyd, Iowa, this fall, according to reports. The plant will be located on the D. Wilbur property and quarrying will be on a royalty basis. About 10 men will be employed, and some of the equipment will be moved from Osage as soon as the power line is completed.

Robert G. Lassiter Co., Jacksonville, Fla., has been awarded a $200,000 contract by the federal government to make jetty repairs at the mouth of the St. Johns river. Of 10 bidders the Lassiter company was lowest. Work is to start within 60 days and to be finished within 180 days. Approximately 45,000 tons of rip rap rock will be used.

Sand and Gravel

Iroquois Sand and Gravel Co., Clifton, Ill., has added a crane and also four Mack trucks to its equipment, increasing the capacity to 700 tons per day.

W. H. Chadwick, Dayton, Ohio, has purchased the W. E. Wroe gravel plant, West Second St., Xenio, Ohio, and will reopen the operation at once, it is reported.

Broome County Sand and Gravel Co., Utica, N. Y., has filed a notice of voluntary dissolution with the state department. The operation of this company was merged with the Eastern Rock Products, Inc., Utica, N. Y.

Concho Sand and Gravel Co., Pawhuska, Okla., has just finished installing additional new crushing equipment at its plant near here, the change resulting in a considerably increased capacity. Fifty men are employed at the plant.

Reed and Wheelock, Clay Center, Kan., recently moved their dredging operation up the river about a half-mile northwest from the former location. New power lines and railroad siding were extended through to the new location.

A. T. Shere, Vancouver, Wash., has opened a sand and gravel plant at the Harmony camp grounds on Salmon creek, just off the Pacific highway near here, turning out both crushed gravel and sand, and expects soon to also operate his own trucks for deliveries.

Cement

St. Louis Portland Cement Co., St. Louis, Mo., recently incorporated, expects to start work within a month on a $2,000,000 plant, according to local newspaper announcements.

Shearman Concrete Pipe Co., 201 W. Clinch St., Knoxville, Tenn., is planning to start erection of a $60,000 concrete pipe plant on Sholar Ave., East Chattanooga.

Colorado Portland Cement Co. is reported to have started up its plant July 21, after a three weeks' shut down for repairs and vacation period. About 100 men are employed and it is expected to continue the operation well into the winter.

Lehigh Portland Cement Co., Metaline Falls, Wash., is installing a new fine grinding process costing $50,000, which is expected to be completed about September 1, when the plant will be started with a full force of 100 men.

Signal Mountain Portland Cement Co., Chattanooga, Tenn.; regular quarterly meeting of the directors was held July 25, John L. Senior, president, of Chicago, attending. Outlook reported to be encouraging.

Lawrence Portland Cement Co., Thomaston, Maine.; reported to be running to full capacity with 200 men employed, with a large part of the output going to the Bingham dam and to concrete road building in Maine and New Hampshire.

International Portland Cement Co., Spokane, Wash., whose plant at Irvin, Wash., is reported to have been shut down since April, resumed operations August 2 at half capacity. Outlook is for increased business during the fall.

Pennsylvania-Dixie Cement Corp., Valley Junction, Iowa; the local council passed a resolution asking the company officials to take means to reduce the dust coming from the plant and calling for a joint meeting August 18, to take steps toward definite action.

Great Lakes Portland Cement Co., Buffalo, N. Y., Adam L. Beck, president, reports shipments 3½% greater for the first half of 1930 than the corresponding period last year. The plant is running at about 60% of capacity and employing 250 men. The company is said to be 50% owned by the Lehigh Portland Cement Co., through which its entire output is sold.

Glens Falls Portland Cement Co., Glens Falls, N. Y.; Robert C. Carter and Byron J. Lapham were elected directors to succeed the late Arthur W. Sherman and John E. Parry. Mr. Carter was elected treasurer to succeed Mr. Sherman, and F. W. Wait was elected secretary, succeeding Mr. Parry. Loren F. Goodson was appointed assistant treasurer.

Missouri Portland Cement Co.'s projected plant at Tulsa, Okla., is expected to get under way in August, according to Tulsa newspapers. Plans are now practically completed, it is said. It is announced that the company will be incorporated under the laws of Oklahoma under a name different from that of the parent company, and that two Tulsa men will serve on the board of directors. The plant will employ 250 men.

Miscellaneous Rock Products

Raleigh, N. C.—Considerable interest is being shown in the North Carolina mineral deposits and a number of investigations and prospects are under way, according to H. J. Bryson, state geologist, who predicts that a new mica plant will soon be built in the state. Mr. Bryson receives a great many specimens from different parts of the state which he identifies without charge.

Agricultural Potassium-Phosphate Co., Los Angeles, Calif., recently organized with capital of $1,000,000, has purchased former plant of American Potash and Chemical Co. at Los Angeles Harbor for a new plant for manufacture of commercial fertilizers and kindred products. Headquarters will be established at once. Company has also acquired phosphate properties near Paris, Idaho, for raw material supply and will install rock crushing plant, conveying, loading and other equipment.

J. B. Snider, president of the American Stone Co., Jackson, Miss., has taken an option with Steward Gammill and Robert Kinnard of the Pearl River Gravel Co. at Kinnard, 30 miles south of Jackson, for sands suitable for making glass. The option calls for a 20-year lease for the full supply of glass sand. Mr. Snider proposes to organize a company and build a factory to cost $200,000, in Jackson, for the manufacture of glass. With this sand, which is said to be the only sand suitable for glass making in this section, and a plentiful supply of natural gas, a successful outcome is anticipated for the new industry by its promoter.

Obituaries

Dens Marois, 64, founder and treasurer of the Marois Sand and Gravel Co., Worcester, Mass., died August 1.

W. D. FOULKE

William D. Foulke, 62, for many years treasurer of the Western Wheeled Scraper Co., Aurora, Ill., died July 23, following 36 years of service with the company. Mr. Foulke was closely identified with the earth moving industry and was known by many contractors throughout the United States.

J. W. Brannon, 61, president of the J. W. Brannon Sand and Gravel Co., Denver, Colo., died August 6. Mr. Brannon was a native of Ohio, going to Colorado in 1891, where he organized the sand and gravel company a few years later.

Morris Botter, president of the Botter Building Materials Co., New Haven, Conn., died August 3 at the age of 56.

Frank J. Oakes, 54, general superintendent of the Dodge Works of the Link-Belt Co., Indianapolis, Ind., died suddenly at his home on July 19. Mr. Oakes was a recognized authority on mechanical engineering and during the world war was selected by the government as a designer and adviser on the manufacture of munitions. He spent considerable time in developing processes for the heat treatment of steel and contributed valuable information as a result of his experiments. He was sent to Europe by the Link-Belt Co. to investigate new mechanical inventions and to study chain manufacturing processes, and holds several patents on inventions in the chain industry and in other fields.

Personals

Hollie C. Ellis, formerly sales manager of the Ohio and Michigan Sand and Gravel Co., has been appointed secretary to Mayor Jackson, Toledo, Ohio, to fill the position vacated by Virgil Sheppard.

Porter W. Yett, Portland, Ore., president of the National Association of Paris Transit Mixed Concrete Manufacturers, is on an extended eastern trip to the Atlantic coast to visit various concrete manufacturing plants operating under that system.

Carl H. Winterfeld of the Winterfeld Builders Supply and Coal Co. has been elected president of the Toledo Concrete Block Manufacturers Association, Toledo, Ohio. R. A. Barnes was elected secretary and treasurer.

William Piez has been appointed European correspondent for the Link-Belt Co., Chicago, Ill., and will direct his efforts toward bringing about closer contact between the company and its agents and customers located in Europe, the British Isles and North Africa. He is a brother of Charles Piez, chairman of the board of the company, and has lived in Paris since 1928.

Scott Turner, director of the United States Bureau of Mines, sailed recently for Southampton, England, preparatory to visiting heads of the mining departments of various European nations, with the object of obtaining information regarding the

latest developments in those countries along the lines of safety and efficiency in mining and technologic research in the mining and metallurgical fields. He will visit England, France, Germany, Switzerland, Holland, Belgium and possibly Sweden.

Manufacturers

Chicago Pump Co., Chicago, Ill., announces that H. G. Ragan, Brandeis Theatre Bldg., Omaha, Neb., is its representative in that territory.

Cutler-Hammer, Inc., Milwaukee, Wis., announces that it has acquired the Reynolite Division of the Reynolds Spring Co., Jackson, Mich., manufacturer of bakelite flush plates, plugs, etc., under the name of Reynolite.

Robins Conveying Belt Co., New York City, has been granted by the Adams Coal Machinery Co., of Plainfield, N. J., the right to manufacture and sell the Adams "Avalanche," "Withdrawal" and "Floating" chutes to the different industries and operations where bulk materials such as coal, coke, stone, sand and gravel are handled.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., announces the appointment of Fred T. Whiting as assistant manager of the northwestern district under N. G. Symonds, commercial vice-president. Mr. Whiting, who is a graduate of Iowa State College, has been with the company since his graduation in 1913, and has been located in Chicago since 1917.

American Refractories Institute, Pittsburgh, Penn., has recently published the eighth edition of "Brands of Refractories." The booklet lists every known manufacturer of fire brick in the United States and Canada, together with a list of the brand names of their products. Copies may be obtained from the secretary of the Institute, Oliver Bldg., Pittsburgh.

Fate-Root Heath Co., Plymouth, Ohio, manufacturer of Plymouth locomotives, announces that it is now represented in New York and New England by John H. Neafie, with headquarters at 115 Broad St., New York City. Mr. Neafie, who formerly represented them in association with George H. Fanning at 50 Church St., New York, under the name of Neafie and Fanning, has acquired Mr. Fanning's interest.

Link-Belt Co., Chicago, Ill., announces that its Pacific Division has just moved from its old plant to a new manufacturing plant and office at Paul Ave. near Bayshore Highway, San Francisco, Calif. The company has 16 plants and warehouses located throughout the country, and this new unit consists of a two-story office building, a warehouse 8x120 ft., three stories high, and the manufacturing building, containing the machine shop, steel shop, plant office and auxiliary departments.

Speeder Machinery Corp., Cedar Rapids, Iowa, manufacturer of Speeder gasoline, electric and Diesel powered shovels, cranes and draglines, announces the following additions to its sales organization: R. F. Sanchez as export manager with offices at 50 Church St., New York City; B. C. Larrabee as district sales engineer with headquarters at Seattle, Wash.; Harry E. Zabel as district sales engineer with headquarters at St. Paul, Minn.; W. A. Avery as district sales engineer with headquarters at Chicago; R. C. Higley as district sales engineer with headquarters at Dallas, Tex.; A. D. Lane, formerly district sales engineer, with headquarters at St. Paul, has been transferred to the central southwest territory with headquarters at Kansas City, Mo.

Trade Literature

NOTICE—Any publication mentioned under this heading will be sent free unless otherwise noted, to readers, on request to the firm issuing the publication. When writing for any of the items kindly mention Rock Products.

Safety Appliances for Mines. MSA catalog No. FA-1 illustrates, describes and gives prices of all MSA first-aid materials and equipment. MINE SAFETY APPLIANCES CO., Pittsburgh, Penn.

Pumps. Bulletin No. 14 describing and illustrating centrifugal pumps and water supply systems and also condensation pumps. CHICAGO PUMP CO., Chicago, Ill.

Pulverizing Equipment. Folder lists results of Raymond equipment in various plants in the rock products field, giving production, fineness and grinding cost covering each installation. RAYMOND BROS. IMPACT PULVERIZER CO., Chicago, Ill.

Locomotives. Bulletin describing gasoline locomotives in two- to four-ton sizes, with Ford "AA" engine and transmission, steel frame and tires. Includes table of hauling capacities on various grades. BROOKVILLE LOCOMOTIVE CO., Brookville, Penn.

Boilers. Type C 3-drum Erie boiler is illustrated and described in New bulletin (A.I.A. File No. 30-C-1, Heating; A.I.A. File No. 34-B-1, Power). A feature of these boilers is that they are adapted to restricted space conditions. ERIE CITY IRON WORKS, Erie, Penn.

Two new books that will interest users of speed reducers

Speed Reducers. Two new catalogs describing construction and application of speed reducers and giving engineering data on them. Catalog **B-1** covers planetary type reducers and Catalog **C-1** worm gear types. GEARS AND FORGINGS, INC., Cleveland, Ohio.

Pumps. Circular describing a new portable lightweight compressed air operated sump pump driven by a rotary air motor. It has a capacity up to 120 g.p.m. and is lowered into the sump, using ¾-in. air hose and 2½-in. water hose. CHICAGO PNEUMATIC TOOL CO., New York City.

Variable Speed Transmissions. Bulletin describing new electric automatic control and electric remote control equipment for use with Reeves variable speed transmissions. The control equipment consists of a small motor and gearing with solenoid brake and mercury tube switches, all of which may be added to manual control transmissions now in use. REEVES PULLEY CO., Columbus, Ind.

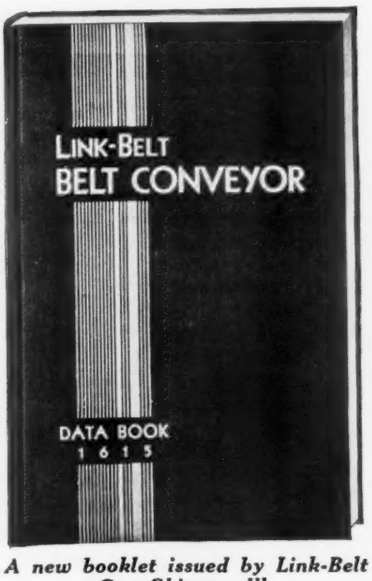
Air Compressors. An article in the July, 1930, Engineering Graphic describes how compressed air is used to transport cement through pipes at modern cement plants. It is illustrated with pictures of operations at various plants and includes information on the amount of air used. SULLIVAN MACHINERY CO., Chicago, Ill.

Crushers—Bulletin **1469-B** describes the Style "B" Newhouse crusher. A detailed description with illustrations is given of its construction, with general dimensions and capacity and power requirements of the three sizes in which it is made. Among the advantages claimed are simplicity, economy and large capacity. ALLIS-CHALMERS

Belt Conveyor Data Book

A NEW flexible covered 176-page data book, No. 1615, has been issued by Link-Belt Co., Chicago, Ill., giving a large amount of information and data on the handling of materials on belt conveyors.

Among the subjects covered are belt stresses, idlers, trippers, feeders, motors, drivers, etc., and engineering data and charts are given on each. Tables of help in selecting the proper belt conveyor for handling any given material and illustrations of typical installations are included.



A new booklet issued by Link-Belt Co., Chicago, Ill.

Oh, for a Limestone Deposit in Iowa!

PROPERTY OWNERS in the Mississippi Valley States, thousands of square miles of which have limestone beds at varying depths below the surface, will certainly get exaggerated ideas of the value of their lands, if perchance they should see various newspaper items which have appeared in numerous localities in Iowa. It would be hard to find more misinformation in the same amount of space. The following, credited to the Associated Press, is from the *Clinton* (Ia.) *Herald* (verbatim):

IOWA LIMESTONE DEPOSIT WORTH $50,000,000 FOUND

Oakville, Iowa, Aug. 1—(AP)—A rich limestone deposit has been found on the Charles Butler farm, seven miles south of Oakville, which chemists estimate to be worth $50,000,000.

The deposits extend 90 feet above the road level and are said to be of commercial value.

Chemists who have examined the deposits said that they contain carbon calside, rich in nitrates, and are extensive enough to warrant their use as commercial fertilizer. They also said the deposits contained large quantities of chalk of the kind that is used as a base for making face powder.

The chemists said their analyses showed the material to be more than 98 per cent pure.

Dr. John P. Magnussen, head of the chemistry department at Augustana college; Dr. Paul Radenhausen of Davenport and Dr. R. Monroe McKenzie, head of the chemistry department of Parsons college, signed the affidavits containing the findings.

The estimate of $50,000,000 as the value of the material in sight was the average placed on the limestone deposits by 10 chemists who examined them.

Burlington business men are understood to be planning to organize a quarry to work the limestone.

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For those who are sufficiently interested to know how the $50,000,000 valuation was arrived at, the following from the *Mt. Pleasant* (Ia.) *News* may prove helpful:

The place is seven miles from the nearest railroad. It is estimated here that trackage and the construction of a road to the farm would cost approximately $10,000 per mile. To truck the material to the railroad would be expensive but this plan is being discussed by those who are interested.

Agricultural limestone brings all the way from $2.50 to $10 per ton, depending on the quality, according to figures produced by the promoters of the project. These prices depend on the mesh, analysis, etc. Talc brings $10 to $30 per ton, also depending on the quality.

With the mine running at full capacity of 100 tons per hour, 300 days a year, sale of 1,000 tons per day at $3.50 per ton would make the yearly net profit $420,700 on $624,500 investment, figures shown in Burlington, business men state. The expense would include all salaries, operating expenses, depreciation of equipment, interest on bonds, everything.

Dr. John P. Magnusson, head of the department of chemistry at Augustana college, says that there is an extreme rarity in nature of a limestone or calcite as pure and crystaline is the white deposits found.